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September 1936

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CLASSIFIED ANNOUNCEMENTS

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DISCOVERY

A Monthly Popular Journal of Knowledge

Vol. XVII. No. 201. SEPTEMBER, 1936.

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Notes of the Month.

NOT for some years have the members of the British Association enjoyed the sensation of seeking new quarters for their annual banquet on the fruits of Science. The last occasion in which a new assembly-place in this country was chosen was in 1919, when the Association met at Bournemouth. Now, again, a famous holiday-resort has been selected, and one in which the science of dealing with large and sudden incursions of visitors has been brought to a fine point. We have no hesitation in declaring that Blackpool will be able to take the British Association Meeting in its stride, and will give its members a hearty north-country welcome; it is certain that their material interests will be thoroughly and efficiently looked after, leaving them plenty of time to pursue the scientific business of the Meeting with unimpaired energy. Lancashire has pleasant associations for the officials of the B.A. At the Manchester meeting of 1861 an attendance of over 3,000 and a subscription of over £3,000 were recorded for the first time; the takings at the meeting at Southport in 1883 were second to this alone, up to that date; while Manchester again, in 1887, broke all records with an attendance of 3,838 and a purse of £4,336—figures that have been surpassed only at the rather exceptional meetings in Australia (1914) and in London (1931).

* * * *

In choosing for the assembly of the members a centre specialising in dealing with the employment of leisure

hours, the British Association authorities have acted with wisdom and forethought. As the President remarks in his message overleaf, the question of leisure occupation is becoming, indeed has become, one of the major problems of the day; and the B.A., yearly more wide awake to its responsibilities as a means of connection between science and the life of the people, has followed an appropriate course in betaking itself to Blackpool. When all is said and done, it must be remembered that it is to science that we owe our leisure, thanks to the technical advances that have increased the rapidity of transport and communications; and it is only just that science should now apply itself to the discovery of the answer to the legendary Chinaman's question: "And what do you do with the two minutes you have saved?" Scientists have a reputation, not altogether undeserved, for caring little about the secondary developments arising out of their inventions; the Blackpool meeting will give them a first-rate opportunity of proving that some of them, at any rate, are willing to talk over the repercussions of modern progress on the lives of the public in general.

* * * *

The present jeopardy into which civil war has brought the many and magnificent monuments of Spain accentuates the position of Portugal as one of the principal centres of stability in Europe. Senhor Luiz Marques, the Portuguese representative of *Industria Britanica*, our contemporary which devotes itself to the development of British interests in Iberian and Ibero-American lands, demonstrated this in a recent address which he gave to a representative gathering in London. "In 1926," he said, "Portugal was in the throes of a vicious party system which crippled progress. Out of this impasse arose a Defence of Portugal Movement, and one of the best things it did was to hold up constitutional guarantees for about three years, and abolish the competition between two or three parties which was handicapping the nation. Dr. Oliveira Salazar, Professor

of Economics at the University of Coimbra, became Finance Minister, and suddenly we began to feel that something had become different. The deficit was a national institution, and it was firmly believed that the resources of Portugal were unequal to the task of balancing the nation's Budget. Dr. Salazar proved the case to be otherwise; he balanced the Budget." The position of Portugal to-day, with a stable financial position attracting (among others more important) that trade which cannot survive without peace—the tourist trade—is due to a member of the "unpractical" professional class. The implication behind this fact is obvious enough to need no lengthy exposition.

* * * *

Science generally, and medical science and archaeology in particular, have lost a great and generous benefactor in the person of Sir Henry Wellcome, whose recent death at the age of 82 we regret to have to record. Sir Henry was born a native of the United States, but became a naturalised British subject in 1910. His connection with the famous chemical manufacturing concern of Burroughs Wellcome & Co., is familiar to the man in the street; British scientists are grateful to him for the Physiological and Chemical Research Laboratories which he instituted, the Entomological Field Laboratories, the Historical Medical Museum, and the Museum of Medical Science, all of which, in addition to the Bureau of Scientific Research, are embraced by the Wellcome Research Institution, whose fine building is among those which have turned the Euston Road from one of the drabest thoroughfares in London into a street worthy of its position at the gateway of a great city. Readers of DISCOVERY need hardly be reminded of the activities of the Wellcome Archaeological Expedition to the Near East, as the fascinating record of its achievements year by year has regularly been recorded in our pages.

* * * *

We are almost tempted to suggest that a spirit of deliberate malice is behind certain public authorities in their apparently ruthless determination to obliterate traces of antiquity in England by the construction of modern works. While aware, of course, that many "picturesque" old cottages, and so on, are unfit for human residence and are little more than death-traps, we could cite the case of many local authorities who have been able to find a better fate for such buildings than demolition. And the sensible action of these far-seeing authorities serves only to bring the vandalism of others into higher relief. "Sheer vandalism," indeed, is the

expression used by the Sub-Committee set up by the Corbridge (Northumberland) Parish Council to consider the course of a proposed by-pass road through Corbridge, which antiquaries fear will threaten the valuable Roman remains at Corstopitum. If the road goes through as proposed (reports *The Times*), it will pass directly over the camp there, undoing many years of careful excavation work on the most completely developed Roman site in the country.

* * * *

Many other instances might be quoted of ancient sites and buildings being obliterated beneath the steam-roller of modern transport. We understand that the old butter-market at Haverfordwest is doomed as an obstruction to traffic: but what exactly is the traffic that has to rush through a small Pembrokeshire town at breakneck speed? Putting the matter on the lowest level, is it not an admitted fact that much of the revenue of our country districts is derived from visitors who come to see the beauty-spots and ancient monuments of the locality? If these are spoiled or demolished, the source of revenue will disappear; the satisfaction to be derived from checkmating a parcel of "old fogeys of antiquaries" will scarcely compensate the erring authorities for the ensuing loss in hard cash.

* * * *

The other side of the medal appears in Sir Charles Trevelyan's announcement of his intention to bequeath his beautiful home in Northumberland—Wallington and its large estate near Morpeth—to the National Trust for the Preservation of Places of Historic Interest or Natural Beauty. He has made provision that from the time of his death Wallington shall become public property "secure from disruption and dispersion," but also ensuring the continued connection of his family with the house and land. Sir Charles, as is well known, has no sympathy with the private ownership of land, but he is at the same time appreciative of the value to the nation of the preservation intact of great houses with the estates surrounding them; and by his will he has secured the Wallington estate both from dispersion and from the danger of selfish ownership, while maintaining at the same time the valuable historical association with the Trevelyan family. Meanwhile it is interesting to note the announcement of the National Trust that they can put an owner of another historic estate comprising about 5,000 acres, who is obliged to sell, in touch with a private individual who is willing to buy such an estate for preservation and would prefer to leave the present owner as tenant.

The Blackpool Meeting of the British Association.

By Sir Josiah Stamp, G.C.B., G.B.E., LL.D., D.Sc., F.B.A.

President of the British Association for the Advancement of Science, 1936.

In its annual British Association number, DISCOVERY has again the privilege of publishing a special message from the President. Sir Josiah Stamp has a particularly interesting task in presiding over the first meeting of the Association in a new centre; and his words show that he appreciates the spirit that prompted the selection of a great focus of leisure for the meeting-place of a learned scientific body.

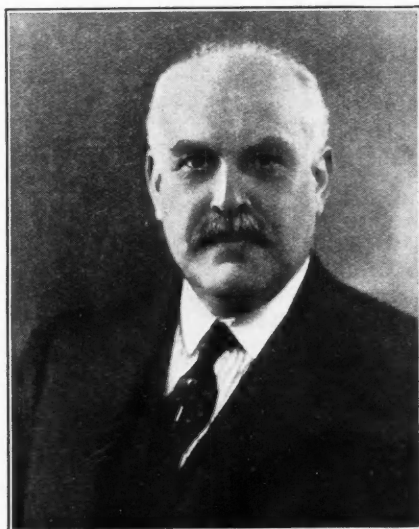
It is a rare thing for the British Association to add a new centre to its list of places of meeting. Almost invariably at the opening of a meeting it has the privilege of making reminiscent comparisons between the present occasion and its previous meetings for some of the centres of its activities have been visited three or four times during the century and personal experience not infrequently spans the full interval between two visits. Since the end of the 19th century it has only had a new centre of meeting on one occasion when Bournemouth was added to the company. Blackpool has risen to power and fame steadily in the last thirty years, and whatever it has touched it has given new meaning to, so that it is not surprising that it is now putting upon the record of its interests an occasion of this importance. Members of the Association, instead of having recollections of their previous Meeting upon which to dwell, are now busy speculating as to the outcome and significance of such a novelty in their experience as a meeting at Blackpool. There are those who think there is something whimsical or almost freakish about the association of the world's greatest centre of mass amusement and gaiety with the serious pursuits of science, and some who think that its many attractions will draw interest away from the Sectional Meetings of the Association. But these speculations are mere trifles on the main stream of confident anticipation of a thoroughly profitable innovation.

Blackpool has as its hinterland one of the greatest industrial areas of the world. It cannot be merely sluggish and contemplative—it is eager, impulsive, forward-looking, change-creating, as science itself ought most often to be, and it has availed itself of all the

applications of science and invention in meeting modern demands for pleasure and leisure. In pursuit of the peripatetic mission of carrying the programme of the advancement of science to all parts of the country, the British Association certainly cannot afford to ignore such an opportunity. Many places of meeting have a special background, either academic—as in the case of a university centre; or architectural and historical—as in the case of a cathedral town; or naturally scientific—as in the case of a centre of geological or botanical interest. Blackpool may, perhaps, not possess any of these three classes of attraction to any distinction, but the British Association is developing overtly the discussion of the relations between science and society. It is becoming, therefore, increasingly concerned not only with the work and business of men, but with their leisure,

the leisure that is created by the increasing success of science in industry. It is seen that if leisure is to be a boon and a part of the good life, it is worth study and scientific examination. The mechanics, the economics, the psychology, even the physiology of leisure time occupations are involved, and the study of them should be both facilitated and provoked in such a supremely significant centre as Blackpool.

It is a mistake to suppose, as the Press sometimes suggests, that the British Association is mainly concerned with highly theoretical and academic discussions of recondite principles and phenomena, and that it needs to be annually goaded into a realisation of responsibility for the applications of science to everyday life. A study of its records shows that it has never been lacking in a plentiful supply of practical applications. Looking back at the meeting of a hundred years ago,



Sir Josiah Stamp.

the meeting of 1836, I find that there were then the papers upon the state of mineral waters, observations of the tides, an improved ear trumpet, the vibration of bells, a new rubber for electrical machines, the weight, height and strength of men at different ages, blow-pipes, the strength of spirits, sugar from mangel-wurzels, acceleration of the growth of wheat, the chemistry of the digestive organs, the performance of steam engines in Cornwall, the effect of railroads on intercommunication. I am sure that no one can complain that at its beginnings the Association had no regard for the social applications of its studies. The fact that with the increasing specialisation of science, papers with recondite titles in some of the sections quite simple and familiar to the student, are brought within the ken of the public by the Press as at no other time in the year, should not deceive us into supposing that the British Association has altered its character. But a conscious or publicised effort is being made to impress the public with the fact that the applications of science to human affairs do, indeed, figure prominently, because in the programme a large number of contributions have now been specially marked to show that they fall within this special category. It may not be recognised by the general public, or by the Press, but often a subject that looks extremely academic and remote is really very close, after all, to human affairs. Some of the mathematics and researches of pure physics develop with extreme rapidity from a row of incomprehensible symbols into a new instrument of human work or interest.

Developing Public Interest.

The wireless, in particular, has proceeded from its beginnings in papers and discussions that in their day would have been regarded superciliously as remote from everyday affairs. But, as it is one of the objects of the Association to develop not only science itself from within throughout its many branches, but also public interest in its advancement, and to create the attitude of mind in the public suitable for the reception of its achievements and reflection upon its significance for life itself, the responsible authorities are ready enough to focus attention upon this special aspect without that really entailing any material change in the character of its work. Moreover, it is not without value to the scientists themselves to be asking questions continually as to the social direction and results of their work. It leads them to connect up their own efforts, however theoretical, with other branches of science, and to make that synthesis which is so important in this day of high specialisation. The increasing number of joint sessions between two or more sections is an

evidence of the importance of combined or borderline work, of the interdependence of all knowledge and of the necessity for continual synthesis of methods, ideas and results. The habit of attending each other's deliberations brings the sections together in a unified whole and makes the Association a genuine unity through all its variety.

The personal contacts in social meeting, the excursions, the common interests, have built up a camaraderie between scientists at the Association in the past which has been of permanent stimulus to their work. The interest taken by the civic and public authorities of Blackpool in the coming of the Association is most encouraging and invigorating and everything that the members can desire. Nothing is now lacking to the stimulus of a great occasion in which all concerned can both contribute and receive abundantly.

General and Sectional Meetings.

THE Inaugural General Meeting will take place in the Empress Hall, Winter Gardens, at 8.30 p.m. on Wednesday evening, September 9th, when Sir Josiah Stamp, G.C.B., G.B.E., will deliver the Presidential Address, dealing with the impact of science on society. Subject to subsequent announcement, admission will be by membership ticket; seats will not be numbered, and there will be no individual reservation of seats in advance. The First Evening Discourse will be delivered on Friday, September 11th, by Mr. Clifford C. Paterson, O.B.E., and will deal with science and electric lighting. The Second Evening Discourse will be delivered by Capt. F. Kingdon Ward, and will deal with plant-hunting and exploration in Tibet. Public lectures will be given in neighbouring towns, including Lytham St. Annes, Poulton-le-Fylde, Preston, Southport, Fleetwood, etc. Lectures to young people will be arranged in Blackpool, including one by Brigadier H. S. L. Winterbotham, C.B., C.M.G., D.S.O., on Crown Colonies in Africa. The Mayor and Mayoress of Blackpool (Alderman Walter Newman, J.P., and Miss Newman) will hold a reception in the Winter Gardens on Thursday evening, September 10th.

The Amenities of Blackpool.

The special characteristics of Blackpool must be known at least by hearsay, if not by actual personal experience, to all members of the British Association. Surely no other town in the British Empire is so well qualified to deal with the sudden incursion of huge crowds, whether bent on the serious business of a con-

ference or simply determined to make the most of all the resources of amusement that a great amusement-centre can offer. In view of the subject of the first Evening Discourse, it is appropriate that members should have the opportunity of witnessing the annual autumn illumination of the sea-front, which begins on Saturday, September 12th, and promises to be a model of all that modern electric-light technicians can contrive in the way of civic gala-lighting. The Reception Room will be accommodated in the spacious premises of the Boys' Grammar School, Raikes Parade, and the Sectional Meetings will be held for the most part in other scholastic buildings.

Though apart from the arrangement of the sea-front and promenade, which are a fine example of civic architecture applied to special needs, Blackpool does not in itself vaunt any particular features of immediate interest to the Association, it is of importance as an anteroom to two of the most remarkable districts of England, as remarkable in themselves as they are different from each other. These are the great manufacturing district of Lancashire and West Yorkshire, and the wild and pastoral county surrounding the fells of Furness and Westmorland—the English Lake District. Excursions, suited to all tastes, have been arranged into both of these areas, and a four days' excursion to the Isle of Man, after the Meeting, is under consideration.

Among the works and research stations that are being visited are the Research and Testing Laboratories and Dye-house Department of Imperial Chemical Industries Ltd., at Blackley; Metropolitan-Vickers Works, Manchester; Potato-Testing Station, Ormskirke; and Mussel-cleaning Station, Lytham. It is hoped that an opportunity will be afforded to inspect farms in the Lake District and at Preston, and also the Freshwater Biological Station, Wray Castle, Windermere. Educational institutions which will be open for inspection during the Meeting include Lancashire County Council Agricultural College, Stonyhurst College, and Rossall School. Archaeologists may be reminded of the proximity of the extensive ruins of Whalley Abbey, and the less well known remains of Cockersand Abbey, near Lancaster.

Sectional Presidents.

The President of Section A (Mathematical and Physical Sciences) is Prof. Allan Ferguson, author of about fifty papers on capillary and other physical subjects, and Assistant Professor of Physics, Queen Mary College, London. He will speak on "Trends in Modern Physics."

Professor J. C. Philip, O.B.E., F.R.S., President of

Section B (Chemistry), who will speak on "The Training of the Chemist for the Service of the Community," is also the author of a number of original papers, and is Professor of Physical Chemistry, Imperial College of Science and Technology.

Section C (Biology) has Professor H. L. Hawkins for its President. His address will be on "Palæontology and Humanity," a subject upon which he has written much during the sixteen years in which he has been professor of geology at Reading University.

Dr. Julian Huxley will give his presidential address to Section D (Zoology), on "National Selection and Evolutionary Progress," upon the study of which, among other things, he has built up his great reputation.

"Mapping of the Colonial Empire" is the subject chosen by Brigadier H. S. L. Winterbotham, C.B., C.M.G., D.S.O., President of Section E (Geography), General Secretary of the International Geodetic and Geophysical Union.

The Presidential address of Dr. C. R. Fay to Section F (Economic Science and Statistics) is entitled "Some Aspects of Commercial Agriculture." Dr. Fay has been Reader in Economic History at Cambridge since 1930.

Professor W. Cramp, President of Section G (Engineering), and Professor of Electrical Engineering at Birmingham University since 1919, will speak on "The Engineer and The Nation."

Woman President for Anthropologists.

Section H (Anthropology) is presided over by Miss D. A. E. Garrod, Director of Studies in Archaeology and Anthropology at Girton College, who will speak on "The Upper Palæolithic in the Light of Recent Discovery."

Professor R. J. S. McDowall, who will address Section I (Physiology) on "Integration in the Circulation," has been Professor of Physiology at King's College, London, since 1923, and was previously Dean of the Faculty of Medicine there.

Section J (Psychology) will hear its President, Mr. A. W. Wolters, speak on "Patterns of Experience."

Mr. J. Ramsbotham, O.B.E., has chosen "The Uses of Fungi" for his address to Section K (Botany).

Sir Richard Livingstone, who will speak to Section L (Education) on "The Future in Education," has been President of Corpus Christi College, Oxford, since 1933, and was the author twenty years ago of "A Defence of Classical Education."

Section M (Agriculture) will hear Professor J. Hendrick, Strathcona-Fordyce Professor of Agriculture, University of Aberdeen, speak on "Soil Science in the Twentieth Century."

Creating New Species :—II. Animals.

By C. H. Waddington, M.A.

Following his account of the creation of new plant species, published in DISCOVERY last October, Mr. Waddington explains the processes by which new animal species—or something very like them—are artificially evolved. A plain and easily understood exposition, such as he gives us here, is more than welcome.

Civilised man has, in a few thousand years, profoundly altered some types of animal which formerly evolved very much more slowly. The milch cow, the sheep bred for wool, the Shetland pony, and the Shire horse are very considerably unlike their wild ancestors, and the differences have been brought about in the comparatively short period during which the animals have been domesticated. The technique which has been employed is selective breeding. This can be effective only if appropriate hereditary variations can be found, but, given suitable material, it acts in the same way as, and much more rapidly than, the process of natural selection which occurs among wild animals. Starting from the wild dog, domestic selection has produced animals as dissimilar as the St. Bernard and the Pekinese.

But all the various types of dogs are regarded as belonging to the same species. That is to say, they can be cross bred with each other and give fertile offspring, though in some combinations the puppies are very weakly. Different wild species of animals, though they may look more alike than two dogs, can usually not be crossed, or at least give infertile hybrids like the mule. This failure to interbreed cannot be taken as an absolute sign of a specific difference; but there is no doubt that the origin of two different species from one common ancestor involves not only the accumulation of

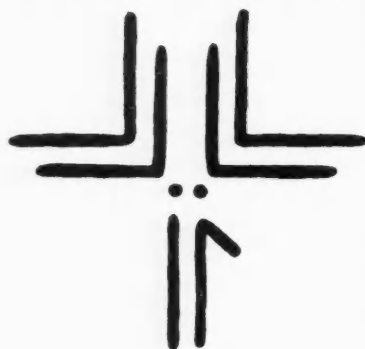


Diagram of the chromosomes of a male *Drosophila melanogaster*: a rod-like X-chromosome, a J-shaped Y, two V-shaped pairs (the second and third chromosomes), and a pair of small fourth chromosomes.

different hereditary factors in the two races but also the production of some mechanism which makes it unlikely, if not impossible, that the two new variants shall mix together again by hybridising. The mechanisms that occur in Nature are varied; some depend on the habits of the species involved,

but in most cases the mingling of the two races is prevented by the fact that the two kinds of hereditary material will not work together in the hybrid to form fertile germ cells, so that if a hybrid ever does arise it cannot reproduce itself.

The hereditary material of animals, and also of plants, consists of the chromosomes, small darkly staining bodies in the nucleus of every cell. In each species there is a definite number of chromosomes; usually an even number, since there are always two of each kind of chromosome except sometimes for an unpaired chromosome which is concerned in the heredity of sex. Along each chromosome the hereditary factors, or genes, are arranged in a row in a definite order. The inability of the chromosomes of two different, but nearly related, animals to work harmoniously together in a hybrid is probably due more to differences in the order in which the genes are arranged than to actual differences in kind between the genes in the two sets. We can deduce a little about the differences in gene-order by observing the behaviour of chromosomes in hybrids, but the only way to analyse the position fully is to make a long genetical investigation of the nature and position of the genes in the various species. This has been done with only a very few animals as yet; most completely in the case of the little flies of the genus *Drosophila*, which one often sees round overripe fruit or empty beer bottles, and which breed quickly enough in the laboratory for a thorough genetical study.

The species within this genus differ from each other in such a way that it seems that the chromosomes have been broken into a few rather large pieces and then joined together again in the wrong order. Thus *Drosophila simulans* differs from *Drosophila melanogaster* chiefly by having the genes in a section of one pair of its chromosomes in the opposite order, as though a part of the chromosome had been picked out and replaced back to front. In *Drosophila pseudo-obscura* we seem to have caught the process of evolution red-handed; there are two races, which can scarcely be called different species since it is quite impossible to tell them apart by eye, but in one of them there is a reversal of the gene-order in part of one chromosome pair.

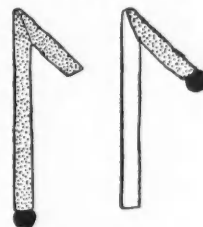
Chromosome aberrations of this kind occasionally occur in ordinary flies kept in the laboratory; but

they are found much more frequently in flies which have been subjected to X-rays. They seem to be due to a failure of the mechanism by which the chromosomes divide at the time of cell division. The simplest sort of rearrangement consists simply in the loss of a section of the chromosome; it is usually a section in the middle which disappears, or is "deleted," the two ends joining up to make a shortened chromosome. In other cases, which, as we have seen, occur also in Nature, part of the chromosome is turned round or "inverted," and in others again a fragment of a chromosome is broken off and joined up with another chromosome, when it is said to be "translocated."

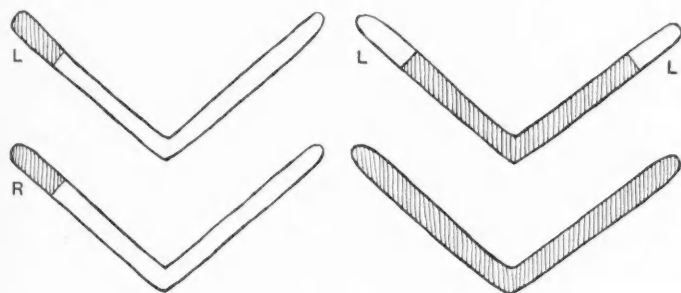
The inversion of a section of a chromosome does not usually have any effect on the appearance of a fly, and is not of itself sufficient to cause us to classify the animal in a new species. Translocations, however, have more far-reaching effects, and by using the artificial translocations provoked by X-rays, some new races have been built up which would probably be given specific rank if they were found wild. The difficulty in making such races is that it is always necessary to preserve the normal balance between the various parts of the chromosomes. If, for instance, part of chromosome

at each end, while the pieces that had been broken off from the two ends of the third chromosome were translocated on to the two seconds. In the new chromosome set the two members of each pair were not exactly like their partners, but they were like enough for normal functioning. On the other hand, if a fly of the new race is crossed with the ordinary *Drosophila melanogaster* the hybrid is very infertile.

The other new race has an even more striking rearrangement of its chromosomes, since it only contains three pairs instead of four. The pair which has apparently disappeared is the fourth pair of very small chromosomes, and as a matter of fact they are still present although they are attached to other chromosomes and therefore not so easily visible. The rearrangement took



A male of the new race, showing on the left the Y-chromosome (dotted) to which a fourth chromosome (black) is attached, and on the right an X-chromosome (white) to which is attached a fragment of the Y carrying with it the translocated fourth.



Exchange of the two left ends of the second chromosomes (white) with the two ends of one third chromosome (shaded).

A gets translocated on to chromosome B, we have always got to have two of the B's-with-the-extra-bit-of-A whenever we have the two remainders-of-A, otherwise there will be some of A missing and the fly will not live.

The two most remarkable races of this kind have both been made from *Drosophila melanogaster*. This species has four pairs of chromosomes, two big V-shaped pairs called the second and third chromosomes, a pair of very small fourth chromosomes, and the pair of sex chromosomes which consist in the female of two rod-like X chromosomes, while the male has one X chromosome which has an unequal partner, the J-shaped Y chromosome. In one of the new races the left ends were removed from both the second chromosomes and translocated to a third chromosome, which had one

place in two steps; first one fourth chromosome was translocated on to the end of the "empty" Y chromosome which is only present in males and carries very few genes. Then part of the Y with the attached fourth was translocated on to the X chromosome. The chromosomes of the new race, with composite X's and Y's, are shown in the third figure. These flies also are fertile with others of the same race but give infertile hybrids with other *Drosophilas*.

We can regard these new races as at any rate something like new species, and the way in which they have arisen is probably similar to one of the ways in which evolution goes on in Nature. But the processes which cause the divergence of natural species must usually go much farther than they have in these artificial cases. Whereas the artificial races differ from normal in a small number of large changes, different natural species probably differ in a large number of small changes as well. These small changes are very difficult to detect, and we still have hardly enough genetic data to be sure of them from that point of view, but we are rapidly learning more about them by the investigation of the minute differences between the appearance of the chromosomes of nearly related species, which, luckily enough, can be seen particularly clearly in the salivary glands of *Drosophila*.

Glimpses of Hudson Strait.

By Clifford Goulding Smith, F.R.G.S.

In his hydrographic work on the coasts of Canada, Mr. Goulding Smith has come to know the narrow Northern seas as intimately as may well be. With the growing development of the Hudson Strait route to the wheat-growing prairies of the West, these seas are becoming yearly of more importance, and knowledge of them is an essential part of the progress of Atlantic transport.

"Embark with me while I new tracts explore
With flying sails and breezes from the shore,
But steer my vessel with a steady hand
And coast along the shore in sight of land."

FOR sheer adventure a coastal voyage in Hudson Strait is unique. Here, face to face with stark reality, one cannot fail to be impressed with the aspect of remoteness and to wonder how the inhabitants exist on these bleak shores. A fascinating region it is; theatrical almost, with the glittering ice-cap on its northern shore, its magnificent fiords and skerries, its newly-discovered reversing falls, and its great tides. Nature has crowded throughout the length and breadth of this great waterway a superb panorama of wonders.

The spirit of romance clings strongly to this bleak sea of the north and it can well be proud of its historical associations. Martin Frobisher it was who first entered the strait in 1578, and Davis, sighting the entrance again in 1587, and seeing the water "whirling and roiling," called it the "Furious Overfall." Let us follow the turbulent waters as they sweep westward along the south-eastern coast of Baffin Island.

Standing sentinel at the northern entrance to Hudson Strait is Resolution Island, its bold, rocky shores swept by the strong tidal currents. It is one of the most lonesome spots in the world, where the cry of the sea-birds keeps time with the beating of the sea against the cliffs. In our small motor-cruiser, bobbing up and down on the waves, we sail along its shores, past inlets, imposing headlands, and low granitic points polished by the ice in winter and the waves in summer. Shambling along the shore of a small rock island, his great bulk standing out in contrast to the dark colour of the rock, is a white bear. On seeing us he retreats behind a hill, but curiosity soon gets the better of him and out he comes again to get a better view.

Caught in the Tide-Race

Soon we arrive off the north end of Resolution Island, separated from Baffin Island to the north by Gabriel Strait, famous for its treacherous tides and formidable coasts. Except during slack tide on a calm day, the crossing of this turbulent 20-mile stretch can always be depended upon to be something of an adventure. To-day a little wind causes a confused sea, with remarkable tide-rips boiling like a witch's cauldron, and before we are

well out into the strait our boat is caught by a stray tidal current and hurled broadside to the heavy short sea. After taking a few lops aboard and momentarily expecting worse, we suddenly find ourselves in an area of calm, but amidst the surrounding turmoil the unnatural placidity is more ominous than reassuring.

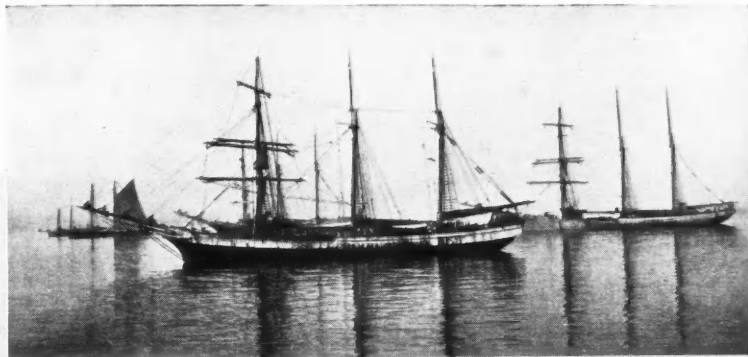
Looming ahead and rising out of the great depths of Gabriel Strait are the Lower Savage Islands. Thrown up in great disorder, these wild, naked crags break into uncompromising cliffs at the sea edge. The waters between these islets are fairly well stocked with seal, but the desolate place is shunned even by the Eskimos, who fear its coasts and hesitate to cross Gabriel Strait in their small boats. But, for all their grim appearance, a little harbour is snuggled amongst these Savage Islands, and when charting this vicinity in 1934, we made our base here.

Friendly Foxes.

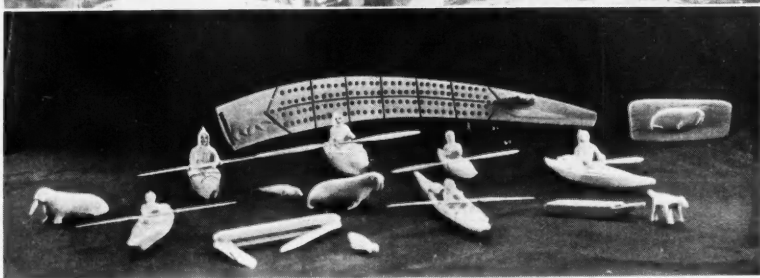
At the beginning of that season our island companions were numerous white foxes. Very cautiously, at first, they approached our huts, but upon assuring themselves that their rather unattractive fur at that time of year held no enticement for us, and especially making sure that we were unaccompanied by dogs, they became quite friendly and, for all the world like playful young puppies, would romp about the huts and bark for scraps of food. At this time their competitors for the cook's favours were the ravens who, boldly disputing the ownership of choice morsels, would swoop down and take a piece of meat almost from under the very nose of a young fox.

But the foxes' security ended abruptly when, later in the season, we were visited by a roving band of Eskimos and a large pack of hungry dogs, all closely packed in a small whaleboat. Two of the women rowers carried on their backs young babies, lulled to sleep by the to-and-fro motion of their rowing mothers and by the low murmur of Eskimo lullabies. Coming within sight of our camp the Eskimos could scarcely believe their eyes when they saw our population of foxes sauntering nonchalantly about the huts. Suddenly their dogs caught the scent, and with the prospect of a chase and the reward of a dainty meal of white fox, they instantly sprang to life. Almost before the craft touched

Right: Fishing schooners in Davis Strait. Below: Enjoying the white man's hospitality.



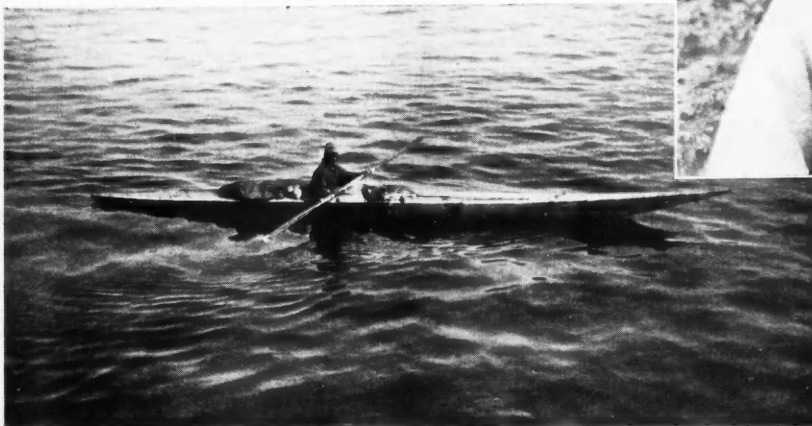
Eskimo boat nearing the Baffin Island coast.



Carvings in walrus-tusk ivory.



Above: An elderly devotee of Lady Nicotine. Left: A kayak in northern waters.



GLIMPSES OF HUDSON STRAIT

the shore, over the side leapt the half-wolves, deterred neither by the shouts of the natives nor by a welter of oars on their backs. Up the bank raced the hungry brutes, followed by a shower of pots and a miscellaneous collection of anything that came to the natives' hands. The foxes, with one quick look at the awful apparition coming straight in their direction, made for the hills, and the dogs immediately spread out to hem them in. But the foxes have dug-outs and holes in the rocks and they soon disappeared from sight, never to be seen around camp again that season. One by one their pursuers returned to camp crestfallen and, hungry as ever, were obliged to revert to their usual occupation of beachcombing for a living.

On arrival our Eskimo visitors numbered twenty-two. A few weeks later one of the natives came to our hut stoically striving to suppress his emotions. Several times he opened his mouth to speak but each time the expected words failed to come. Eventually, however, he made us understand that a "blessed event" had just occurred in the tribe and that he was one of the most interested parties. The happy occasion called for congratulations all round, a little stimulation for the father and presents for the mother and child. The following night the natives held a dance to celebrate the occasion and the mother, carrying her new offspring on her back, provided the necessary music for the festivities by playing an ancient accordion.

An Eskimo Dog-Fight

In contrast to the usual tranquillity of the Eskimos their dogs have a great faculty for getting into trouble and sustaining an air of excitement wherever they happen to be. Most of all they love a fight, and not infrequently the whole pack will turn on one dog and sometimes devour him. Fighting tactics are varied to suit the occasion. Our huts were erected about 20 feet above high water and close to the edge of a cliff. One night a young pup, venturing near the brink of the precipice, got into an argument with one of his friends who, watching his chance for a strategic body-shove, soon found the opportunity and promptly sent his adversary flying into the sea. The lusty cries of the victim brought the whole pack, who stood peering over the cliff, each one eager to catch a glimpse of the young combatant below being dashed by the waves against the perpendicular cliffs. All the onlookers, shouldering each other at the top of the cliff in order to get a better view, seemed thoroughly to enjoy the impromptu show—all, that is, except his mother who, seeing her son's plight, came to our hut and with a great scratching and commotion at the door made us realise that assistance was needed. Quickly she urged us to the scene of the disaster;

and fortunately, by climbing down the scaffolding of an automatic tide-gauge there installed, we were able to rescue the victim.

Nearly a Victim

The dog who informed us of this accident herself soon met with misfortune. She was a great favourite among our sailors and later, when she failed to return to camp for a space of three days, a search party was organised but failed to find trace of the missing dog. The next day, however, while charting the coast from a small motor-cruiser, our attention was attracted to a raven circling above a certain spot on the shore and emitting an occasional hoarse croak. Becoming suspicious we steered towards the shore. At the place where another raven now took to the air we saw our dog with her foot caught in an old rusty fox trap, which had evidently been there for years. Though not sufficiently strong to cut her foot it still had sufficient strength to hold its victim fast. Snow had fallen, and by the imprints in the snow we could see that the raven had walked round and round the doomed dog. Just out of the dog's reach, the carrion bird waited the opportunity to pick its prey to pieces when, through hunger and anxiety, the dog became too weak to resist. For several days, with its cruel, beady eye fixed steadily on the wretched victim, the bird had kept up its relentless march of death. High overhead circled its mate, watching the grim drama and waiting to take its turn in wearing down the resistance of the now almost exhausted victim, whose gratitude seemed to know no bounds as we lifted her into the boat. But hardships are soon forgotten in the north and in a few days she was running around with the pack, as fit as ever.

From the summit of the Savage crags one can obtain a spacious view, especially northward, where, into the icy waters of Davis Strait, Baffin Island points a great white finger on which sparkles a cold white jewel. The great Grinnell Glacier this is, whose gleaming white surface can be seen from far out at sea. "Meta Incognita" (Worth Unknown) Queen Elizabeth called this gigantic peninsula which separates Hudson Strait from Frobisher Bay, and for centuries this name has stood as a challenge to science. At the tip of the peninsula and forming the great south-eastern cornerstone of Baffin Island is the imposing rampart of rock known as East Bluff. For centuries this grim headland has borne the brunt of the terrific winter onslaught of the ice. Frowning defiance at one of the most inhospitable stretches of water in the north, it has never failed to evoke a keen sense of awe in those who have passed by.

From a high coastal hill in Baffin Island can be

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obtained an enchanting view of the glistening glacier merging subtly with the clouds. The strip of bare country between the glacier and the sea is so hilly that it resembles a rough sea—a sea furrowed with wild ravines and crested with white patches of snow. Placid lakes nestle amongst the hills and swift-flowing rivulets course down from the melting glacier. The rock-bound shore is fringed with many islets and rocks and indented by numerous bays and inlets. Here we come in contact with the Eskimos in their native haunts and can replenish our larder with the finest of sea-run salmon-trout, weighing up to 12 pounds. These fish are easily speared, caught by a troll or a net, or even by hand, but they are disappointingly unresponsive to the enticing gyrations of a feather fly, their apathy possibly due to lack of acquaintance with anything resembling these colourful, if not very nourishing, tidbits.

Though bleak beyond description, the south coast of Baffin Island provides such variety of physical features that, as we cruise along its rock-bound shores, we are never for a moment bored. Now, attention is attracted to a small islet as its population of sea-birds rises screaming at the chug-chug of our engine and, concluding that this must be one of the nesting places of the eider duck, we decide to investigate. We land under the lee of the islet and step ashore carefully as the rock is studded with nesting birds and temporarily vacated nests with bluish-coloured eggs in all stages of development. Here and there are young birds peeping out of their shells and young ducklings toddling into the world. Small downy flocks tumble amongst the rocks and crevices or, perhaps for the first time, take hurriedly to the sea, urged on by the parent birds, who cut strange capers in a brave attempt to divert attention from their fleeing broods.

It is evident that the Eskimos have been here recently, for we notice, neatly stored between rock boulders and covered with seaweed, a small cache of ducks' eggs, apparently to be used later in the year when other food is scarce. The birds evidently do not begrudge this one annual contribution to the native larder for, year after year, they return to the same places and pay the same tribute for the privilege of using the islet to raise their young. But, judging by the raucous commotion now taking place, the feathered inhabitants have mistaken us for a second delegation of tax-gatherers and we are being informed with more vigour than subtlety that this latest invasion of their nursery is both unprecedented and deeply resented.

All morning we have been conscious of an increasing easterly swell, ever a portent of heavy weather in Hudson Strait. Wet winds blow in from the North Atlantic



Hudson Strait in calm weather

and, striking the great glacial ice-cap a few miles inland, condense to clammy grey clouds which settle lower and lower over land and sea. Through the mist the islets appear unreal and the trend of the coast becomes exceedingly difficult to follow. For direction we decide to rely more on the wind than on our small boat-compass which, apparently unequal to this emergency, has become panicky and makes a different guess with every sea we hit. With the turn of the tide the sea grows heavier, the tidal current becomes stronger, and the waves steeper and more confused; and soon our little craft is swept from stem to stern with the flying spray. The sky grows darker now, and what at first was only a drizzle turns to cold torrents of rain and we are soon drenched to the skin with rain and spray. Of all times to choose, the engine now decides to protest at this commotion and threatens to stop on any further provocation. The trouble probably is due to water or rust being churned up with the fuel during the wild gyrations of the boat. Or is it because the critical situation has spurred the engine-driver to attempt long-needed engine adjustments? Whatever the cause we wish that for the moment he would resume his "let well enough alone" policy and allow the engine to keep turning over, however complainingly, until the boat is out of this turmoil. When harbour is reached he will be at liberty to tinker with it to his heart's content.

As we sail along the coast it is interesting to watch the manner in which the islands take on different forms and shapes as they open and close with one another and sometimes seem to vanish as they merge with the shore. Along the misty margins of the peninsula can be discerned some conspicuous monuments now draped in eerie wraiths of fog. On a bleak point jutting out

to sea a mound of rocks marks the last resting place of an Eskimo hunter. Surmounting the grey pile of rocks under which he sleeps are the remains of his old harpoon and close by the grave are numerous of his belongings.

The early explorers, impressed by the wild appearance of the islands that fringe the coast of Baffin Island, applied the same nomenclature to three widely separated clusters. Painted them all with the same brush, so to speak, the only difference being in the handle. "Savage" they dubbed them all—Lower, Middle, and Upper, and the names have stuck to prejudice succeeding generations of men. One of the Middle Savage Island group is Henry Hudson's "Isle of God's Mercie," and another is Saddleback Island, a high, bare crag, so named on account of its shape. Savage they are, to be sure, and bleak is the coast, but through the gloom a glimpse of the islands now is welcome, for they mark the vicinity of a small hidden harbour in Baffin Island where shelter and food can be obtained. Slowly, past numerous small islets, we feel our way through the fog to seek refuge until the approaching storm has spent its fury. The entrance to the little harbour is white with spindrift whipped up by the gale, but on rounding a point we find a sheltered nook. Some Eskimo tents are on the shore, and the natives, surprised to see us emerge from the fog, gather on the beach shouting a welcome in response to our own greetings.

Eskimo Courtesy

After a hurried palaver two Eskimos in kayaks shove off from the shore and with a few strokes of long, ivory-tipped paddles are within speaking distance. Gladly we accept their invitation to go ashore and soon we find ourselves the centre of a welcoming group. Gifts are exchanged—nothing so materialistic as buying and selling, you understand; the exchange of presents is much more to their liking. In the circumstances the mere mention of our paying for their gift of delicious Arctic trout would offend the fine sense of hospitality which prohibits turning a stranger's needs to one's own advantage. Characteristic of their Oriental origin, these delightful little people have a highly-developed sense of courtesy. Our presents of tea and sugar are received with many spontaneous little squeals of delight from the women and many a hearty "Na-kor-mik" (thanks) from the men. In the Eskimo realm tea is highly prized, but as a luxury Lady Nicotine reigns supreme. The naïve suggestion offered by numerous pipes, evidently long empty, being drawn from the farthest depths of deep pockets or else hanging disconsolately upside-down from drooping mouths of men and women, makes a most subtle appeal.

Subtle, but this time not immediately compelling,

so a native presents, with a few deprecatory remarks as to its value, a piece of ivory delicately carved from walrus tusks. Perhaps it is a miniature ivory kayak, complete with hunter, tiny harpoon, and other weapons used in hunting the seal. Perhaps a tiny ivory polar-bear or a walrus with little tusks exquisitely proportioned and highly polished, or else an Eskimo *komatik* (sledge) complete with driver and several dogs neatly harnessed. Well do the natives know that such rare ivory carvings will draw the last ounce of tobacco from the private stock of their southern visitors. Having given one of these they stand back and wait for the result. To insure that their purely friendly motive may not be mistaken they may even risk the chance of protesting against our proffer of tobacco, though pipes are unconsciously being handled in readiness for a long-needed smoke. This is our cue, of course, to insist strongly and at the same time to hand a tin of tobacco to the one who presented the ivory carving.

Good! This time he responds to the occasion by helping himself to a large handful of tobacco, puts a little in his pipe, a lot in his pocket, and generously passes on the tin. A couple of others follow his example and before it has scarcely begun its rounds someone pockets the container. A second canister meets the same fate, so we decide to call a halt and discuss the weather. But the interlude does not last long, for with these first gracious ceremonies of welcome so properly completed, trading can now be indulged in freely. When it comes to trading, sailors and natives everywhere take second place to no one in their love of exchange and bargaining. Boxes of cigarettes quickly vanish and the odour of the fragrant weed draws trifling goods of exchange as a magnet does bits of steel. A walrus tusk, either in its natural state or carved into a cribbage-board, is given for a sailor's knife or other trinket. After the limited stores of knick-knacks are exhausted, even clothes are exchanged and soon we see our hearty sailors arrayed in odd pieces of Eskimo apparel and the native women decked out in colourful shirts, worn much like blouses, but with the shirt tails dancing merrily in the summer breeze.

Profit before Propriety

The feminine enthusiasm for bargaining must be somewhat inherited, for did not Captain Lyon, over a hundred years ago, in his record of his voyage to this part of the world, remark: "to enliven the scene, about 60 Eskimaux, men and women in kayaks and oomiaks, made a loud screaming noise and brought with them some trifling articles of barter, chiefly weapons and skin clothes? I blush while I relate it," he says, "two of the fair sex actually disposed of their nether garments

—a piece of indecorum that I had never before witnessed." Let us hope that the immodesty which caused the good captain's blushes at least helped to dispel the widely-held notion that the land of the Eskimo is always cold!

Far from being a land of perpetual ice and snow, Baffin Island in summer presents a sprinkling of vegetation very respectable for a land so far north. Deep in the glens are thickets of Arctic willow. Days are often uncomfortably warm, and in the long days of summer, daisies, buttercups, bluebells, and many other familiar wild flowers bloom profusely. In the bright sunshine Eskimo youngsters romp and play and chase the brightest coloured butterflies much as do the children of more southern latitudes. On such a day one scarcely thinks of winter conditions.

With clearing skies the country assumes a much more pleasing aspect, and with farewells to our native friends we soon are on our way to more unfrequented haunts. The whole coast is enthralling and one would like to explore every inlet and climb to the summits of the polished rock islets that fringe the coast. Here and there a large Arctic hare can be seen galloping along the hill-slopes or an old bewhiskered walrus gazes curiously at our boat as we sail by. Eventually we arrive at Barrier Inlet, and everyone, now on the alert, is speculating on something of more immediate concern. There, where the fiord narrows, a group of rocky islets stretches almost from side to side, leaving only narrow openings through which the great tides roar as they pass into the inner reaches. In one of these dark openings we can see white water, much disturbed, like a great boiling-up which, from a distance, we might mistake for a school of white porpoises. But we have little time to conjecture as to the nature of the disturbance for soon we find ourselves in a serpentine trail of froth and whirlpools and are conscious of a strong current. Suddenly we realise that a cataract of the sea is before us, but, fortunately, the current is outward so we approach closer.

The Reversing Fall.

A strange sight, this curling and crashing of the sea over the rocky barrier! Beyond the falls the height of the water is about eight feet above our own sea-level, for it is the time of the great spring tides which, in this part of Hudson Strait, have a range of 36 feet. Fascinated, we watch the water lowering in the inner fiord while the sea rises steadily outside at the foot of the cataract. This phenomenon continues during these spring tides for a space of about 2½ hours, but gradually the waters approach the same elevation and the cataract vanishes. Eventually, all is quiet, and we can sail into

the inner reaches of the fiord. But quiet reigns for only a few minutes and unless we are prepared to stay inside the fiord for the next five or six hours we had better not enter or our launch will be trapped inside. Imperceptibly at first, but growing stronger and stronger, the current between the islets now flows inward. Before long, the mad waters again whiten with rage at the obstruction and great waves careen wildly from side to side, the serpentine tongue of froth extending now in the opposite direction from the main tumult.

"Briggs His Mathematics."

This is one of Baffin Island's showplaces—reversing falls not unlike the renowned example on the St. John River, New Brunswick, which henceforth must share Canadian honours with its hitherto unknown northern brother. It is extremely unlikely, however, that tourist traffic will be diverted on that account. So far the only persons known to have seen the northern freak of Nature are members of the hydrographic expedition and the Eskimo who, by the way, not inappropriately call it, "The Place that Never Freezes." Every little inlet and islet along the coast has its own Eskimo name, usually selected to indicate a characteristic of the place. Many are long and difficult to pronounce and consequently only a few have been retained on the chart to indicate the Eskimo habitation of the coast. Historical place-names are mostly associated with the early adventurers or the wealthy courtiers who sponsored their voyages. Altogether alluring are many idyllic and fanciful titles of this pageant of Nature: "Cape Hopes Advance," "Briggs His Mathematics," "Cary's Swan Nest."

The North will always be the last great treasure-house of the world, but until recently its inhospitable confines have discouraged all but the most cursory examination by an adventurous few. It seems a pity, but the greatest obstacle to the development of the north has always been the unfounded notions of its uselessness. With the advance in science, however, a change has taken place—a change, not only in the north itself, but what is more important, a change in the opinions of men.

Of Hudson Strait one must dispel the idea of a region of crashing icefields and of a grim procession of icebergs sailing up and down the strait. Winter conditions are always harsh and the fierce dictates of the elements then must be obeyed. The wind speaks and the north stops to listen; the cold stills, but the summer brings a great dynamic life. Science and modern aids to navigation have robbed Hudson Strait of its terrors but its glories will always remain. They are as enduring as the ageless rock, as dynamic as the sweeping tides, as elemental as life itself.

Population: a Primary Problem

By L. E. C. Hughes, Ph.D.

No system of planning for the future can afford to neglect estimating the magnitude of the population it has to deal with. In its studies the Engineers' Study Group on Economics, of which Dr. Hughes is a member, is investigating the economic repercussions of the impending decline of population in this country.

It is generally realised that populations in this and other countries are not rising so rapidly as they used to, but the latest sociological investigations, particularly by Dr. Enid Charles, on the habits of civilised populations are revealing conditions which, to put the situation mildly, are alarming, especially since no one seems to know what to do about it. The basis of this position is explained in the following discussion.

The vital statistics of population concern the birth and death rates and the distribution of ages in the existing population. At first sight it might be thought that provided the birth-rate exceeds the death-rate, the population continues to increase. This deduction neglects the age distribution of deaths, and particularly the time element. The net increase is certainly determined by the excess of the birth over the death-rate, but this is not the factor which determines whether in the long run (and it is of little use looking only a few years ahead) the population is going to increase or decrease.

According to the biologists, the factor which ultimately matters is the *net reproductive rate*. The *gross reproductive rate* is measured by the number of girl-children each woman has, which also are to have girl-reproductive children, there being a substantially constant ratio between the sexes. Taking various losses into account, the population remains stationary in the long run if the net reproductive rate is unity; if greater than unity the population ultimately increases, if less, there is a decline.

Incomplete Data

Having obtained a measure of population trend, this yardstick can be applied to populations over a period of years and the likely trend estimated. Unfortunately, statistics in most countries are inadequate for these calculations. In this country, vital statistics go back about a hundred years, but the present method of taking census or other data does not at present provide for determining the composition or pattern of existing or completed families; the lack of the latter data inhibits the calculation of the future trend of net reproductive rate; it may go up or down. The only country which publishes sufficient data is Australia and its figures are being analysed by Dr. Charles.

We know quite well that the population of this country increased markedly during the last century. This was not due to much change in the birth-rate; in fact, for fifty years the net reproductive rate remained practically constant; the increase was substantially due to reduction of the mortality rate, both for adults and infants. About fifty years ago the net reproductive rate began to decline in most countries of Western Europe, until, with few exceptions, it has dropped well below unity. Canada is above unity, the United States below. Italy is just above unity, but as the decline has been rapid since the war, there is every indication that it will soon fall below unity. Countries in the east cannot be estimated, because of lack of data.

Declining Reproductive Rate

The net reproductive rate for this country is 0.72. Its future value cannot be estimated because of lack of data, but it is on the decline, and no one can suggest any certain way of controlling this figure. Supposing that this figure is maintained, which is a distinct possibility, it means that the population will creep up to a maximum about 1941, and then decline slowly until 1960. After that date, the decline will be accelerated, due to the increasing average age of the population, until, in a hundred years' time, the population will be four millions, and in several hundred years the population will be countable on the fingers.

A reduction in the net reproductive rate will accelerate these figures, a slight increase merely retard them; their results can be obviated only by an immediate increase of this rate to unity, which is practically impossible. There are mitigating factors, such as a reduction of maternal mortality, the larger fraction of which, being preventable, could be eliminated with suitable organisation; and reduction of infant mortality (in Oslo it is about one-third of what it is in this country). Such small numerical changes as can be attained in these directions are totally ineffective in markedly affecting the net reproductive rate, the changes being in the second decimal place; something more radical must be done.

When these data are applied to family patterns, it is clear that the net average of all family groups should include two reproducing children. This means, allowing

for women who do not have children for a variety of reasons, and losses through death, that the average existing family should include four children at least.

This should be the modal number; for every family of three only, there should be one of five; to compensate for families of two there should be the balancing number of families of six; and so on. That this is not so is evident everywhere. In the past, families up to a dozen children were frequent, particularly in the country, where the average number in a family is higher than in towns; nowadays, families greater than five are certainly unfashionable, and the most frequent family contains only one child.

Various reasons can be put forward for this trend, although it is difficult to state one that is decisive. The obvious excuse for the declining size of family is the increasing use of modern contraceptive forms of birth control. This started about 1880 and is spreading from the wealthier classes, who can command scientific knowledge, downwards, although proper contraceptives are not yet within the reach of the poorest classes. This differential change in class fertility need not be a disadvantage, provided that the best mentalities can freely rise through the various sociological strata. This vertical freedom of movement makes, incidentally, for the safety of society; suppressed and frustrated mental energy among the lower classes is liable to lead to revolutionary changes as contrasted with evolutionary changes in our social systems. There is, however, evidence that the poorest

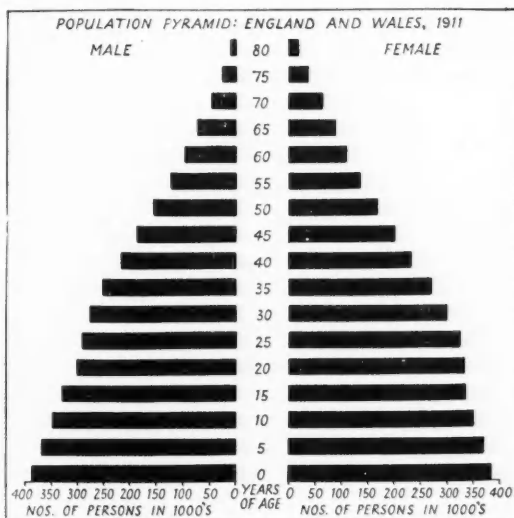
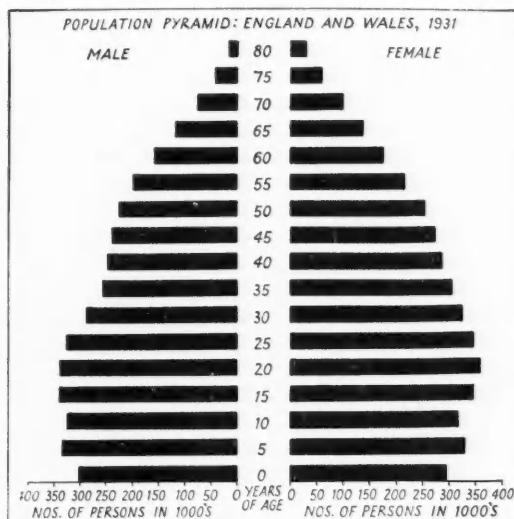
classes do not have the large families which were at one time inevitable.

Birth control is, however, not an end in itself, but is largely determined by economic and, occasionally, medical reasons; the charge of selfishness can be applied both ways. Various schemes of family endowment have been proposed to ease the financial burden of normal families. In some countries, extra salary payments are in force for family responsibilities; a scheme of family allowances has been adopted by the staff of the London School of Economics for four years, but whatever the aim in view may be, it seems too soon to judge of any results.

A recent inquiry amongst university teachers resulted in the estimate of an increase of 4 per cent. only in total salary for a system of adequate family allowance; it is evident that such schemes must be applied for specific defined groups before experience warrants the wholesale adoption throughout the country. In the opinion of the statisticians, no such scheme is likely to be of any use in altering the net reproductive rate.

There is, incidentally, a suspicion that some part of the widening effect of birth control may be automatic rather than voluntary, due in fact to increasing personal hygiene over the last half century. Baker has shown that soap solution is more spermicidal than most chemical contraceptives, and that increased hot bathing may be a major factor in involuntary birth control and apparent infertility.

Another major factor is housing. In catching up



[From "The Struggle for Population" by D. V. Glass. By courtesy of the Oxford University Press]

The Population Problem at a Glance.

In the lower diagram it is clear that any age-section of the population will be replaced by that below it as time goes on. In the upper diagram it is evident that this replacement is becoming impossible.

Another major factor is housing. In catching up

omissions in housing due to the War, the houses being erected on a very large scale make no provision for families of four or more children; none for large families are being built, whereas there should be at least 25 per cent. available for this purpose. In the great majority of existing housing schemes there are no spaces for families, and this is a definite bar to reproduction. The encouragement to buy, fostered by building societies, is anti-social in this respect, since it entices persons into buying small houses because of their existing incomes and thus hinders their removal to large premises at a later stage, even if such existed. To have a large family, it is essential for the parents to start at an early stage, and this is offset by the tendency to postpone marriage, either on account of the desired higher standard of living when both parents are single, or from actual delay in obtaining an adequate income in an age when the acquisition of specialised knowledge postpones more than ever remunerative employment.

Women in Industry.

In considering the forces which keep women out of marriage, the increasing opportunities for women to play an important part in extra-family life must be held only partly responsible. An intelligent woman can easily have one or two children without appreciably jeopardising her career, whether in factory, office, or consulting room, provided that she can balance her budget. This is not the point however; the pressing need is for families of four or more, and no married woman can make such a family less than a whole-time job, particularly if they are spread out, as is usually advocated. Moreover, there seems no appreciable proportional increase of married women in industrial employment now as compared with before the war.

In Germany great numbers of women have been induced to leave industry on marriage by means of bonuses, on the condition that they do not return. This undoubtedly will have a marked effect on the birth rate, but exactly how much and for how long it is too early to say. Wars and other catastrophies leave kinks in the vital statistics, but these soon get smoothed out and leave no permanent impression. Whether the threat of war and its effect on a future generation has any personal effect on birth control is a moot point.

What Steps can be Taken?

The optimists insist on automatic rectification of the present state with the establishment of adequate conditions of living and security of the future. Others point out that population trends in the past have fol-

lowed augmentation and decline of the supply and distribution of food. This cannot be valid at the present time, since the supply of food for the world population is adequate, and its distribution only dependent on political arrangements between the interested countries.

It is often said that the optimum population of this country is about twenty millions, *i.e.*, less than half what it now is, and we could then be economically self-sufficient. If that is the desired end, it is of no use expecting the population to stop at twenty millions when it has declined to this. To anticipate a halt at this figure, the low reproductive rate must be attacked now; it is no use later on, the time element is against us.

What steps are to be taken is by no means clear. It is evident that large families are not popular, and these are essential to stem the almost inevitable decline. The one outstanding necessity is to re-create the idea that a large family is desirable and honourable. Parenthood must have its status restored and other competing social attributes degraded. Medals and bounties are but temporary and sporadic expedients when one is dealing with what may turn out to be a change in human nature.

[This article was written before the publication of the book on population reviewed on p. 300].

Visual Education.

VISUAL education creates a breadth of vision and understanding which develops into real appreciation of subjects which would otherwise be too technical for the average mind. Limit of time in education excludes many subjects in the organised syllabus. Introducing films into Schools of all kinds will give a wealth of detail which in many subjects cannot be conveyed in words, and which no text-book can illustrate.

The teacher may perhaps imagine that he would be needed less. On the contrary visual lessons will need his attention to see that the children have seen, understood, and remembered. He will also have to assist materially in creating educational films in conjunction with the actual film producers.

The moral effect should quickly be seen in young children after school age.

Only very few are given natural ambition to pursue anything cultural very far. But if the seed of beauty, interest, and ambition is sown at an early age, the interest created in the poorest mentality must provoke beneficial reactions. Therefore leisure will be used for the pursuing of intellectual, manual or artistic interests, which will have started in the Nursery School stage.

The plastic and receptive mind can again benefit two-fold. Children are still told that "seeing is believing." That may be a Victorian statement, but seeing is understanding, which is the all-important point.

Or again, "see for yourself" is an old and much used axiom. Surely an organised form of cultural seeing is an advantage difficult to dispute.

Psychology and Industrial Progress.

By Captain J. H. Blaksley, M.C., M.A.

National Institute of Industrial Psychology.

The very rapidity of the advance, in recent years, of scientific methods has not unexpectedly led to great irregularity of development. There are too many salients in the front line of social progress and it is the duty of the industrial psychologist to smooth these away. All may not agree with Captain Blaksley's recommendations, but he certainly shows up some of the ridiculous anomalies of modern industrial affairs.

To some extent every age is the rebellious child of its predecessor, but since the Reformation no generation has been so much in rebellion as the present against its whole line of ancestors. Democracy, the War, and mechanical invention have "called into being a new world," and the traditions upon which the greatness of England was built are no longer treated with reverence and hardly with respect. The criterion of the present generation is effectiveness in coping with the problems of the hour: even to the soldier of 1936 the man who experienced the War is something of a fossil. The old conservative mentality is alarmed at this drastic break with the past. It mistrusts the power of reason, especially of middle class reason, and in the race of modern progress it sees the stampede of the Gadarene swine. But as Harold Cox once said, "Unless we run the risks that liberty involves we shall never attain the progress that liberty creates." We have now embarked on the experiment, hitherto unknown to history, of maintaining an old civilisation on the basis of industrial democracy, and we must face the risk of our adventure.

The Value of the Human Being

The problems which crowd upon us demand both the economic and the psychological approach. The immense expansion of our trade in the reign of Queen Victoria was largely due to the acceptance of the lessons of "orthodox economics." But the sense of proportion was lost between the value of things material and the value of human well-being, and bad working conditions with great social distress was the price paid by the nation for the one-sided and unbalanced development of the nineteenth century. The Labour Movement has insisted not only on a wider distribution of the proceeds of industry but also on a wider recognition of the value of the human being as a source of national wealth. It has re-echoed the thought of Goldsmith at the dawn of the Industrial Revolution:

"Ill fares the land, to hastening ills a prey,
When wealth accumulates and men decay."

It has also insisted on the principle that the life of every man should be regarded as an end in itself and

not merely as a means to the better life of another, and that it is the function of the State to safeguard the right of every citizen to some opportunity.

Quack Remedies

In any healthy society the principles accepted in theory must be expressed in practice in the daily life of the citizens: the constitution, as the Greek philosophers taught us, determines the character of the State. Since the first Reform Act the centre of political gravity has shifted from the country house to the employer's office, and from the employer's office to the workshop. Many times since the War a real danger has confronted us of the workers using their power to flaunt the axioms of political economy and to adopt quack remedies for curing the evils of poverty. This danger appears to be receding. But it is the task of knowledge and of science, which is "knowledge reduced to system," to point the way towards a balanced approach to the problems of work and of leisure and to promote the well-being of the worker on a basis of sound economics. Our task in other words is to combine the psychological with the economic approach.

The term "psychological approach" includes the physiological and the psychological in its strict sense of mental. As Dr. C. S. Myers, the Principal of the National Institute of Industrial Psychology, has said, "The objects of the Institute are, briefly, to reduce wastage of effort, time and material, on the one hand, and to reduce fatigue, monotony, irritation and unrest, on the other hand, by applying to industry the sciences of physiology and psychology—the sciences of the living body and the human mind—which have so clearly already proved their practical use in their applications to medicine and education." The tendency in the past has been to approach the problems of environment and of working conditions too exclusively from the "engineering" point of view and with too little regard to the standpoint of the workers themselves. A workshop, for example, might look brightly lighted at night and be free of obvious shadows, and the management would think all was well, when closer scrutiny would

reveal such things as waste of light in places where it was not required, irregularity or glare in others, and the unavoidable casting of irritating shadows by the workers in the process of bending over their work. Dingy-coloured walls may easily absorb over half the light which might be reflected back on to the work, and a few years ago a case was recorded by a member of the Institute's staff of a fifty per cent. wastage of daylight through the windows not having been cleaned for six months! The concentration of light as and where it is wanted and the comfort of the workers are the two elementary principles of any sound system of artificial lighting, and yet they are ignored in practice time and again to the detriment of the workers, the firms, and the community.

Take again the question of heat and ventilation. Everybody knows whether a room is too hot or too cold, and most people realise that a room (like a crowded bus on a winter's day) may be both cold and stuffy. But few people appreciate the value of moving air compared with still air, and of relatively dry air compared with excessively damp air, although attention to these two factors may easily make possible a ten per cent. increase in production without the expenditure of one iota of extra effort. Not so very long ago a foreman in a large bakery complained to one of the Institute's investigators of the slackness and lack of conscientiousness of his men. They were pampered, spoon fed, and had learned all kinds of nonsense at school—so different from when he was a boy. When the air conditions of the bakery were tested, the "Kata-thermometer" revealed most unsuitable conditions; and the atmospheric humidity of the room was practically sub-tropical. The "slackers" were working under conditions which would not have been pleasant for black men.

Psychology and Environment

The aim of industrial psychology on its physiological side is to remove all unnecessary hindrances and obstacles which prevent a man from giving of his best—in the selection and training of personnel to eliminate as far as possible the misfit and (what is far more prevalent) the partial misfit who just stands the test of results but has really missed his vocation; and in the matter of working methods and working conditions to render possible the attainment of the maximum result with the minimum expenditure of energy and effort. The effect, too, of environmental conditions on the workers' attitude of mind is coming to be recognised more and more. Suppose a man of intelligence finds his work handicapped by bad light, shortage of tools, defective processing or whatever it may be, he

will quickly calculate the time it would take him to pay in extra output for the cost of remedying the defect. If he is working on piece rates he will feel deep resentment at the opportunity denied him of permanently adding to his earning power, and whether he is on piece-work or time work he will suffer the irritation of unnecessary strain and boredom, lose pride and interest in his work, and grow embittered towards a management which is neglectful of opportunities for improving the prospects of the firm and with them the security of the employees. Most workers, no doubt, do not reason things out very thoroughly, but they realise semi-consciously when there is waste of opportunity and suffer inarticulate discontent. The field for the practical application of a progressive industrial psychology is immense. The human element is the one factor which is common to all types of industry from the combine employing its twenty thousand to the little workshop in the side street, and from the great multiple store to the simple, old-fashioned village shop.

A Break with the Past

It is not big guns nor even high finance that ultimately rules the world. Action is the offspring of thought and emotion. Seldom if ever has the need for the study of the sources of action been as great as in the years which have followed the War. Although the old order had been challenged in the world of thought and defeated in the sphere of politics, religious and social tradition set the standard of behaviour in the England of 1914. But four years of war effected the changes of forty years of peace, and the bewildered England of the Armistice had to face an outlook on life to which normally it might have grown accustomed by 1968. It is this break with the tradition of the past, religious, intellectual, and social, that has enhanced the importance of the working of the individual mind and the minds of men in crowds in the day-to-day affairs of life.

Intellectually the English democracy has not yet found its feet. When the issues are serious, its judgment is extraordinarily sound, but at present it is the judgment of a natural "horse-sense" rather than of a reasoned conviction. In everyday affairs the youthfulness of its undirected taste is revealed by the inanity of most popular films and by the delight in rushing aimlessly about the country in motor cars. But sub-consciously its better elements are searching for disinterested leadership, though with good reason to be cautious and suspicious. It is in the factory and the workshop, the new national centre of gravity, that understanding guidance is most needed. Here we meet the practical problems of maintaining interest

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in work with the rapid increase of mechanisation, of the use of leisure with the shortening of the hours of work, and of the relationship between employers and employed with the diffusion of democratic ideas. Security at a living wage and the desire for a higher wage are no doubt the main incentives to effort. But unless work is to be segregated from life they are by no means the only incentives. Working merely for pay is quite different from being paid for work. Nor will a conscientious sense of duty alone suffice to integrate work with life unless the worker's interest in his task is aroused and some scope for his aptitudes is afforded. One man delights in the creative, another in organisation, a third in handling machinery, and a fourth in a life on the land; and where the interest conjoint with ability lies is the most likely field for success. It is one of the ironies of the situation that as interest in life has widened with the extension of education, the advance in mechanisation has taken interest out of many kinds of work. To restore to the work of the operative the interest of the work of the craftsman is clearly an impossible task. But much in this direction can be done. By more scientific selection men of constructive ability can be relieved to a certain extent of work which is purely routine, and within the routine work itself the extreme differentiation of function can often be profitably restricted. A case is recorded by the Institute where an appreciable profit resulted from allowing girls to break the monotony of filling small tins with liquid by carrying them to the inspection department instead of leaving the carrying to girls of a junior grade. More important perhaps is to let the workers understand how their own individual tasks contribute to the corporate whole. This can be done by explanation, and still better by showing them the processes. Interest in the work of the group is at least a certain compensation for the monotony of the share of the individual.

The Problem of Leisure

But far the best compensation for the drabness of mechanised production is the shortening of the hours of work, and this process has already reached the stage where the problem of leisure emerges. To say that the age of scarcity has yielded to the age of plenty really confuses the issue. Human demand is insatiable and the luxuries of the few of to-day will be the necessities of the many of to-morrow. The problem in its economic and financial aspect is to balance supply and effective demand—*i.e.*, demand backed by purchasing power—and to balance effective demand and the resources of supply. Its social and psychological aspect is to prevent material progress outpacing human

development by making a practical reality of the distinction between leisure and idleness. An immense field is developing for the study of the economics of leisure, but they must not be the "false economics, which emphasise the barter of commodities instead of the exchange of human services."*

Some Grievances

Beneath the daily life of industry lie the problems of industrial relations. At its root is the anomaly that "the top dog in politics is the bottom dog in industry." In such questions as the Indian constitution, Abyssinia, and national insurance employer and employed have equal power. In the affairs of the industry and the firm from which both derive their livelihood, the power of the employee is negligible. And, what is still more important, the employee knows all the time that unless he is backed by a trade union, he depends for security of employment upon his employer or some underling. Will the economic strength of this system resist indefinitely the pressure of democratic ideas? The answer largely depends upon the extent to which employers work in the spirit of the age and become the qualified leaders of industrial democracy. A country normally gets the sort of government it deserves, and employers get the sort of trade union. Fairly recently in a certain large concern a few men working on a night shift asked (very reasonably) for higher pay than the day shift. The management told them they would consider their application and meet them the following day. In the morning a message was sent them by an unpopular foreman that their demands could not be considered, and that the management declined to see them. The men went out on strike and during the next few days several hundred other men struck in sympathy. The management then sent a message conceding the original demands and a good deal besides! They were, however, too late, and the whole works came out on strike. Another instance is that of a large retail shop where an element of discontent contributed to a high and costly labour turnover. An outside investigation into the sources of the trouble revealed that the girls serving on the ground floor felt aggrieved because the bonuses they received on their takings were at a lower rate than those of the girls on the floor above. The management had very properly made the distinction because of the proportionately greater amount of custom on the ground floor. But the girls themselves did not know this. When the position was explained to them their discontent disappeared.

A prominent man in the coal trade recently remarked

* *The Will to Work* (p. 78), by Dr. G. H. MILES, Director of the National Institute of Industrial Psychology.

that in his industry the problem of industrial relations was fundamentally psychological. This is true of most industries. The occasion of a dispute is usually economic: the underlying cause psychological. If each side better understood the workings of the other's mind much trouble would be averted. Only too often amongst employees there is the fear, suspicion, and mistrust which springs from the sense of economic and social inferiority, while among the employers there are still too many men who stand on their dignity because they have so little dignity to stand upon. Where employers show trust in their workers and invite their trust in return, show by example the discipline they

rightly require in the factory, and show too a personal interest in the comfort and well-being of the men; where it is known throughout the works that if a wage cut is necessary it will start with the managing director, and that strict and equal justice prevails with a *bona fide* right of appeal—where in a word employers follow the traditions of English leadership, they gain the respect of their workers and the confidence which generates stability. In industry as in war morale is the primary factor. To promote the well-being of the worker on a basis of sound economics is the contribution of industrial psychology to the betterment of national life.

The Romans in Surrey.

By S. E. Winbolt.

The excavation of a Roman tiler at Ewhurst, Surrey, by the Archaeological Society of Cranleigh School, is a fine piece of concrete historical study. None is better qualified to describe the excavation and the light it throws on Roman-British life, than Mr. Winbolt, to whom the discovery of the site was mainly due.

IN 1923, while I was investigating the course of the almost totally lost Roman road from Rowhook (Sussex) on Stane Street to the Roman settlement on Farley Heath (Surrey), a man who had formerly ploughed a field, now pasture, called my attention to a corner of it where his share used to strike red brick. On this hint I dug a few holes and found Roman tiles. The field is a little west of Ewhurst and under (E. of) High Wykehurst. In my map of the road in *Surrey Archaeological Collections* (XXXV, 1924, p.59) I plotted in this site with the suggestion that it was perhaps that of a Roman building. Other activities intervening, I left it at that. This spring the Archaeological Society of Cranleigh School decided to dig there under Mr. R. Goodchild. The digging proved unusually interesting in its development from stage to stage, but I am now concerned with results. First found, 8 in. down, was a roughly rectangular yard paved 3½-4 in. deep with broken Roman tiles of most of the usual kinds—flanged and imbrex roof tiles, box flue tiles, and small hypocaust and floor tiles. It measured about 50 ft. by 30 ft. Many of the pieces were obviously contorted "wasters"—but where was the kiln? It was ultimately found close against the western side of the yard, in good enough condition to make a complete reconstruction certain.

It was one of the best types of Roman tile kiln, and happily Mr. Arthur Acton's excavations at Holt, Cheshire (1907-1915), had opened up precisely similar kilns, though we did not know this till our work was practically finished (*Y Cymmrodor*, XLI, 1930: W. F.

Grimes on Acton's excavations). On ground gently sloping up southward from a stream, from the banks of which the clay had been dug, the Romans dug out a funnel-shaped trench, 7½ ft. across the top, 3 ft. deep from their ground level, 1 ft. wide at the bottom, and 42 ft. long; in the upper end of which, widened to 9½ ft. at the top, they built their kiln, with a floor sloping gently upwards. As the kiln was only 9½ ft. square, and the fire tunnel (2 ft. 4 in. wide on ground level) leading to it was 8 ft. long, it is plain that the 24½ ft. of trench leading up to it had a purpose. This, I think, was twofold: first, to increase the draught into the furnace; and second, to drain the furnace, perforated at the top, in wet weather. Laid along the bottom of the trench were rounded roof (imbrex) tiles fitted into one another, curve uppermost, to carry off storm water down to the stream. They were packed into position with stones and pieces of tile.

The kiln itself, square in plan, was built into the trench, so that its sides and upper end were walled by the natural clay. The central or main flue was 1 ft. 6 in. wide, and at right angles to it on each side were six cross walls, 4 ft. long and 1 ft. wide, built up of broken tiles set in a siliceous clay daub. These were permanent: their faces exposed to the fire were thoroughly vitrified. (Such walls in similar modern kilns were locally called "horses" about 40 years ago.) Between these walls and the last wall and the stoking arch were seven perpendicular-sided cross flues, 6 in. wide, opening from the central flue 1 ft. 3 in. above its floor, and

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sloping up gently outwards at an angle of about 30 degrees. The cross walls were carried across the central flue by means of arches, built with tiles corbelled out a half-inch at a time. No arch was found perfect, but one left a gap at top of only 5 in., which was probably spanned by a capping tile; the rounded stoking arch also had but a small gap. A little above the level of the top of the arches, the side flues and central arches were no doubt covered with a floor, some 8-10 in. thick, of tiles with rectangular gaps or vents (partly filled in with clay daub) between them, so that the flames and gases of the furnace could get up to the charge of tiles to be baked. Perforated tiles were often used, but none of these was found. A *tegula sesquipedalis* of 17½ in. would span a side flue thus: 5¾ in. resting on one wall, 6 in. over the flue, and 5¾ in. over the other wall, with 1 in. of clay joint over the middle of each wall. The oven floor had been destroyed, but an intact one was found at Holt. The exceptionally long firing tunnel faced nearly N., and this happens to correspond roughly with the orientation of the Holt furnaces; but the direction was due not so much to the intention of catching a north wind—the prevailing wind being S.W.—as of using the upward slope of the ground.

We found the furnace almost filled with rectangular lumps of clay burnt red (rather in the shape of a modern brick, but a trifle shorter), which had obviously been used to wall in the sides of the tiles, stacked up on the perforated floor above the furnace. The oven, like the furnace, was rectangular. The great conveniences of this form of kiln were, first, that the sides of the furnace were the clay sides of the trench, and second, that when



The Roman tiler, looking southward towards the stoking-chamber.



Echurst tile-furnace, looking towards the walled end (N.)

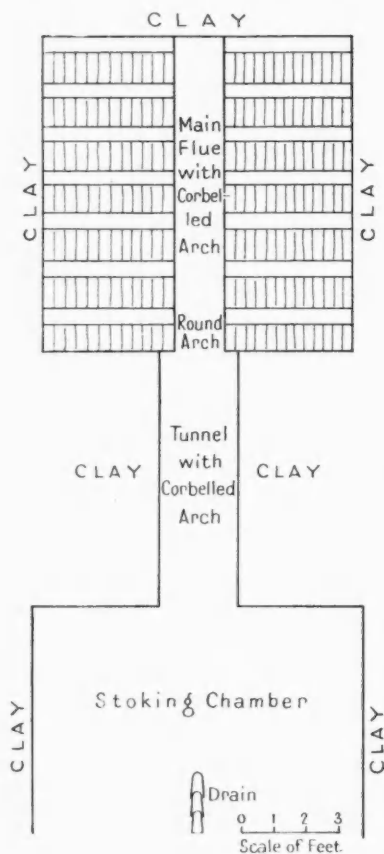
the baked tiles were drawn, they were got out on ground level, and could easily be packed in carts or more probably on pack-horses, to be conveyed over the hill to the Farley Heath township a few miles away. As no other Roman building has been found on the whole nine miles of the road, the destination of the product of this kiln, situated on the last clay available just south of the sand hills, is certain. The kiln was well designed for economy of labour in construction, and in the drawing of the tiles, and for draught and drainage.

The admirable Vitruvius (*De Architectura*, II, 3) gives no account of tile kilns and the burning of tiles, and merely says that there are three kinds of sun-dried *lateres*, the one most in use being the Greek-named "Lydion," 1½ ft. by 1 ft. So little is known, because so little attention has been paid to it by excavators bent on other things, about the economics and industrial aspects of Roman building materials in Britain, that reasoned speculation about the product of such a kiln may be pardonable, and even useful, if only as a quintain for others to tilt at. As a mere excavator is likely to be deficient in knowledge of the technique of brick and tile making, I took into consultation the managing director of the Sussex Brick Company, Mr. Morris Whitehouse, and together we worked out the following.

The oven over the cross-walled furnace had four walls if not of tiles, at least of clay, such as are indicated by our reddened clay bricks, daubed over with a continuous coating of clay mixed with pounded flints, with grasses or straw alternately laid between layers of daub. The top of the kiln would be covered with timbers, with air spaces between. The walls were broken down after

each drawing and thrown on to the yard, and no doubt the oven floor needed repairing.

Can we picture the work of these Roman-British tile makers, and get an idea of the amount of their product? Living in wooden hutments, they dug out the clay in winter, left it out to weather, and tempered it in the spring. The Romans, who had an exceptional aptitude for turning out excellent tiles, used a heavy clay, well tempered and long exposed. There were flints to collect and crush for the siliceous daub; there were moulds to make for the various classes of tiles, and combs and blocks for scoring them with keying, charcoal to burn and underwood to collect from the neighbouring forest. Wooden sheds for the washing and preparation of the clay, and for the moulding and drying of the tiles had to be built and kept in repair. There was water in the nearby stream to the north. In early summer came the repair of the oven floor, especially in daubing up, and the moulding and the firing of the charge, built up from ground level. In our oven there was $9\frac{1}{2}$ ft. square



Plan of the furnace.

of superficial floor space. The tiles were stacked on edge. If proof of this were needed, it is supplied by the strong vitrification of some tiles at one end only: they had been nearest the flame. Nine rows of tiles 1 ft. wide, with a trifling space between the rows, and seventy tiles in each row (probably separated by nipples or bosses of clay) would give 630 tiles in a stage. Assume the length of tiles as $1\frac{1}{2}$ ft., and ten stages at a burning,

and we have 6,700 tiles in a kiln, in a stack 15-16 ft. high. These were walled in as described. The stoker has placed the fuel under the central arch and fired it, and is in his little square chamber (*præfurnium*) outside the tunnel, with store of faggots handy. The burning of the tiles, slow for the first two or three days, and then intense for three or four more, goes on steadily for two to three weeks. Calculating fifteen burnings for the season, we get a product of 94,500 tiles; in round numbers 100,000.

How would these be used? Ordinarily Roman houses are built of stone, with first storey (if any) timbered and plastered, tiles being sparingly used in occasional bonding courses, for coigns, and for the top course on which the roof rested. Roof demanded by far the greatest share of the output. For a building, say, 50 ft. long and 20 ft. wide, the roof would have a superficies of 1,000 square feet, if flat; if pitched, as it usually was, say at an angle of 30 degrees, the superficies would be $1\frac{1}{3}$ of the flat, that is, 1,333 square feet. Taking, as we may do, the square-foot tile as an average size, the roof of our house would require 1,333 tiles, or 1,500 to allow for overlapping. For the four walls allow 20 rows of 50, and 20 rows of 20, making 1,400. Add, say, 1,600 for internal use. Total $1,500 + 1,400 + 1,600 = 4,500$ tiles. To leave an adequate margin, call it 5,000 one-foot tiles for a building. We thus conclude that the capacity of our kiln (100,000 per annum) was enough to supply twenty normal buildings.

Among things learnt by studying the details of our kiln are the standard sizes of flanged roof tiles (*tegulae*). The flanges were approximately 2 in. high; and many of the tiles were 15 in. \times 11 or 12 in. \times 1 in. A specimen 12 \times 12 \times 1 weighs 11-12 lbs. The marks on its lower side show that it was dried on slats $1\frac{1}{8}$ in. wide, separated by ventilating gaps $\frac{1}{4}$ in. wide. Imbrices were approximately 18 in. long, 1 in. thick, with a diameter at the top (or narrower) end of c. 6 in., at the bottom, $7\frac{1}{2}$ in. Tiles of the kind standardised for hypocaust pillars (*pilae*) were 8 or $8\frac{1}{2}$ in. square, and c. $1\frac{1}{2}$ in. thick. There was not the same accuracy of dimensions as in modern bricks. We found none of the wedge-shaped tiles often used for arch voussoirs, and probably none was made here: otherwise they would have been used in the arch which ended the firing tunnel and began the central flue, and in which ordinary flat tiles were used, the wedge being supplied by the mortar course. There were samples of half-round bricks for columns, and one-inch cube tesseræ. All these were red: there were no yellow tiles as sometimes found in Roman buildings, e.g., in the later south wall of Londinium.

In Britain analogous kilns have been found at Ashdon, Essex (1852), Gelligaer in Glamorgan (1913), and Corbridge (1912).

Investigating the Upper Atmosphere.

By R. Lang, Ph.D., A.Inst.P.

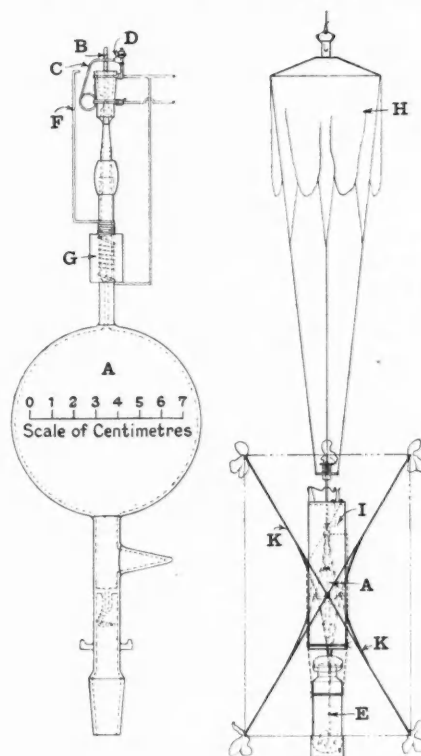
Actual samples of the upper atmosphere of the earth are now being examined, thanks to the ingenious apparatus here described by Dr. Lang. One striking fact, the reason for which is still in doubt, is the increased proportion of helium found in the air at the height of thirteen miles; and further investigation is in hand.

THE importance of increasing our knowledge of the upper atmosphere is becoming more and more apparent and is demonstrated by the growing number of investigations which are being made not only in this country but also in many other parts of the world. The matter is becoming one of immediate practical importance, quite apart from the legitimate aims of science in increasing knowledge for its own sake, for upper atmosphere flights employing sealed cabin aeroplanes or special flying suits have actually been made; and bearing in mind the rapidity with which aviation is developing, the time cannot be very far distant when stratosphere flights will be the common mode of high-speed long distance travel. Then again the meteorology of the upper atmosphere has a bearing on that nearer to the earth's surface, and anything leading to a more complete knowledge of the latter must be of the greatest value. Again, the reason why wireless waves travel round the earth's surface instead of disappearing into space has been explained by investigations of the properties of the upper atmosphere.

One piece of research of great interest now being carried out in this country by the Upper Air Section of Kew Observatory in conjunction with Professor Paneth of the Imperial College of Science and Technology, is that concerned with the composition of the atmosphere at enormous heights. The great difficulty of capturing samples of air at these heights has been most ingeniously solved. It would of course be very costly indeed, as well as slow, to rely only on samples brought back by

pioneer stratosphere balloonists such as Professor Piccard, who has announced his intention of planning a new ascent to beat his previous record of 97,000 ft.

The diagram illustrates the apparatus employed, which is carried up to a great height, sometimes as much as 13 or 14 miles, by a pilot balloon filled with hydrogen, and descends gently by parachute when the balloon bursts. The sample is obtained by a neat automatic device in the glass vessel A of about 18 cubic inches capacity which is exhausted and sealed off before being sent up. The balloon is made of rubber about 0.012 inches thick and is filled with hydrogen at ground level to a diameter of some 5 or 6 feet. The pressure of the atmosphere decreases with height and a time comes when the balloon reaches such a height that the pressure of the enclosed hydrogen so far exceeds that of the surrounding rarefied atmosphere that the strain on the rubber envelope is too great and it ruptures. It is at this point that the glass vessel is automatically opened and closed in the following way, thus capturing a sample of the surrounding atmosphere. By means of a suitable spring, which is released by the sudden



The apparatus employed at Kew Observatory for collecting samples of the upper atmosphere. On the left is a large-scale diagram of the working parts enclosed within the aluminium cylinder (I) shown in the right-hand diagram.

slackening of the suspending cord, an electric switch is closed causing a current from a battery of dry cells to pass through the fine wire D. The battery is suspended below the vessel in a thermos flask E to prevent the very low temperatures at these heights from rendering it useless. The passage of this current fuses the wire D and releases the striker C, which breaks the top of the capillary tube B, allowing the air to rush into the

exhausted vessel A, and subsequently makes contact with the wire F, closing another circuit which passes a current through a small electric heating coil G. A plug of picein wax in the capillary is thereby melted and seals up the tube after some 20 seconds. By this time the apparatus has started on its descent under the control of the parachute H, which serves also to reduce the risk of damage when the apparatus strikes the earth.

The working parts of the apparatus are contained in an aluminium cylinder I, which is in turn fixed into a light bamboo cage K, purposely made as conspicuous as possible to assist the recovery of the apparatus; and for the same reason the parachute is a bright red.

A label offering a reward of five shillings to the finder and giving instructions concerning its return is attached, and I am told by the Superintendent of the Upper Air Section of Kew Observatory that it is surprising how quickly this strange-looking object is found, very often within a day or two, and seldom longer than two or three weeks even in the most remote parts. On hearing from the finder a suitable box is sent to him in which he is requested to post the aluminium cylinder containing the vessel, with its contents from the stratosphere, back to Kew Observatory. The vessel is then forwarded to Professor Paneth for analysis of its contents by special methods. The Ob-

servatory, which is responsible for obtaining the samples, takes great care to send up these balloons only on suitable days when the winds in the upper air are of moderate velocity and coming from such a direction that the balloons shall not be carried over the sea. For this reason comparatively few ascents are made from Kew Observatory, the majority being dealt with by the distributive station of the Meteorological Office, at Sealand Aerodrome, near Chester. Under these favourable conditions about 90 per cent. of the instruments are recovered, and nearly all of them are returned undamaged. More remarkable still, the Superintendent affirms, is the fact that even the thermos flask containing the electric battery, though mainly unprotected, is often returned intact. The length of the flight is not usually more than 60 miles or so. This is largely under the control of the operator who purposely uses safe days on which to make the flights.

Analysis of samples obtained from heights of about 13 miles gave the proportion of helium as 5.7 parts in a million, which is about 8 per cent. greater than the usual proportion at ground level. It will be remembered that helium, one of the rare gases, is the lightest constituent of the atmosphere and is also a product of atomic disintegration, but how this can account for its increased proportion in the upper atmosphere is still a matter for speculation.

Fir Growing on Willow.



grown taller than its accommodating host.

Near the little Austrian town of Bregenz, in the Vorarlberg, this extraordinary "double" tree is a well-known natural curiosity. In the broad head of a pollard willow a fir tree has seeded itself and, finding sufficient soil for its needs, has now

Early Spring World Cruise.

The world cruise of the Canadian Pacific liner *Empress of Britain*, which was varied last season by a visit to South Africa, resumes for 1937 its route via Suez and the Red Sea to India. This route gives an excellent opportunity for visits to interesting points in the Eastern Mediterranean, and especially Egypt and the Holy Land, which were not visited last season.

A very diverse itinerary, which embraces many of the most attractive places in the Malay Archipelago and the Isles of the Orient, is planned for this forthcoming world cruise. From Bombay to Yokohama the cruise follows what can fairly claim to be the most interesting route in the world, with abundant sojourns en route.

Honolulu and the Panama Canal are included on the homeward voyage from the Far East. The *Empress of Britain* World Cruise begins for British and European passengers at Monaco on January 22nd. From here the ship sails first for Naples, and thence for Phaleron Bay and Athens. It then proceeds via Port Said and Suez to Bombay, with full opportunity for a comprehensive visit from that port to India. The *Empress of Britain* returns to Southampton on May 22nd, 1937.

The Canadian Pacific are already running short conducted tours of 21-31 days to Quebec, Montreal, Ottawa, Toronto, Niagara, Chicago, Washington and New York.

A Moorhen's Tragedy.

By Phyllis Kelway.

Miss Kelway's reputation as a biographer of individual wild animals was established by her publications "Widow Hedgehog" and "Hedge Folk in Twilight." Her present study of a moorhen's family is a vivid instance of personal observation, as full of sympathy as it is devoid of sentimentality.

The moorhen is a common bird—a very common bird—in ponds and lakes all over the country, but even the commonest of birds have their tragedies.

The mill dam bordering our garden always gives hospitality to one pair of moorhens. Each year a nest is built upon it, but as the far side is unprotected property and therefore open to invasions from boys, the moorhens seldom rear a brood unless they condescend to favour our bank. Last summer the nest was anchored to our bog-bean some three yards from the land, unhidden and conspicuous, but safe from cats, yet as the fortunes of war would have it, the bottom of the dam had to be dredged, and the water was drawn off on the actual hatching day. Industry does not care for the close contact of

nature; it sucks the life-blood of the country-side and is then powerless to replace its takings. Our protests were in vain. The dam was emptied, the nest sank slowly but inevitably with the water, and the tiny woolly blackamoors who valiantly chipped the shells of their buff coverings were precipitated fifteen feet into squelching mud. I rescued one, washed him, and housed him in the warm greenhouse where he gorged himself on innumerable worms, but his parents knew nothing of the adventures of their seventh son; for them the wreck of their hopes and their home was complete.

In May this year I searched everywhere for the new nest, and eventually discovered it one evening when I

was hoeing willow-herb seedlings from a water bed. Right in the water, a bunch of brown reed stems, dead but still beautiful, was twisted U-shaped outward from

the bank. Beneath the reedy roof, the nest of rough reeds and leaves was well camouflaged and completely concealed until the covering was parted. Safe from cats again, with about four feet of water dividing it from the land, and free from danger of the dam being emptied for several months to come.

Everything in the garden was lovely. The nights re-echoed to the sharp clucks of the love-making pair. Frequent billings and cooings took place among the sedge, and one morning the first buff egg, large and strongly marked with chocolate, was laid. By nine o'clock each morning the lady had

deposited her egg on its reedy bed, and her responsibilities were ended for that day. She laid five eggs on five consecutive days, the first egg being the finest—large, well-formed, and of a colour to correspond with the decaying reeds; but the last of the clutch was small, with brown marks that had dwindled to insignificant speckles. Within that reedy tent the moorhens had established the most vital part of their lives—the reason for their existence. Their nursery was their all-in-all, even before it had been created. With exceeding pride they approached it across the still waters of the dam, jerking their pointed tails and displaying their white tail coverts with cheeky flourish. When the wife sat faithfully hour after hour, the husband made



The Moorhen's Nest

sympathetic noises to her from the far bank, but always he kept his respectful distance. I could no longer watch the mother without disturbing her, as the reeds were too thickly interlaced, but often in the early morning I watched her praiseworthy neat black figure jerking its way to business. Along the crazy paving on the garden side of the reeds I threw crumbs each evening, knowing that moorhens burn the candle at both ends and enjoy foraging expeditions during the night hours. The crumbs disappeared and Mrs. Moorhen sat on.

The Siberian irises by the waterside lengthened their grassy stems; Perry's Blue opened his exquisite china-blue reticulated flowers, holding them erect on the fine bone of his slender stems. Beneath their delicately chiselled blooms Mrs. Moorhen trod the crazy pavement on her long-toed green feet, picking the lumps of fat I had laid for her upon her stone table, and chuckling happily to herself. The days passed and she sat faithfully, patiently, until I expected a chipping of the eggs and a sprawling of black nigger boys.

The Tragedy

The tragedy fell on a Sunday while we were at lunch. Through the window I saw the mill cat crossing the wall from our garden to the mill yard. He walked with slinky, feline tread, ginger head down, and tail drooping guilelessly behind. Before that arch-fiend leaped through the broken window that was his entrance to his rightful home, he turned about, and staring up at the dining-room window twitched his ears forward, and laughed his horrible ginger laugh in our very faces. We could not see the caustic sneer upon his crafty lips for a bulky black object hung downward, from which dangled two long green legs. . . . I shot unskilfully through the window after him, and bounced over the garden wall, but of course, the chase was hopeless from the start.

The bent reeds that edged the nest were blotched with red. The clutch was intact, but a couple of fluffy grey breast feathers fluttered disconsolately above. That evening the husband crossed the dam, clucking anxiously, turning his alert head rapidly from side to side. He called and called. He besought his mate to hurry, as the eggs were chill to the touch—were cold. His imploring voice carried far through the night air, echoing forlornly from the gaunt mill wall until it was thrown back at him, a shattered hope. Yet he must have thought the echo was the call of his wife, for he hurriedly swam across the dam toward the mill and the sound, leaving a wedge of ripples behind him, with the apex close to the white gleam of his tail. Again and again he clucked hopefully; again and again the voice responded. Up and down beneath the mill wall he

swam, puzzled and sorrowful. What lesson he learned under that cruel wall in the shadows of the moonlight I could not tell, but presently he knew his task was vain, and tacking about, he swam slowly and silently to the thick cover of the opposite bank. I never saw him return to the nest; for weeks the damside was strangely quiet.

Cats will be cats just as boys will be boys, but that ginger, in company with feline friends from neighbouring houses, has destroyed the happiness of more families than I care to remember. In our garden the birds nest in every wall, hedge, or tree, but nests of hedge-sparrows, thrushes, wrens, greenfinches, black-birds, and robins are invaded every year, and the young birds eaten as they learn to fly. We have laws for the protection of wild flowers, and for the protection of birds, but we must suffer trespassing cats upon our private ground as though they were our bosom friends. In desperation I have bought tins of the blackest treacle and smeared thick sticky lines around every nest in the garden. In time of drought this method is wonderfully effective, but when the rain falls in a downpour the stickiness becomes a sweet solution and is quickly absorbed into the soil. How gladly would we suffer earwigs on our choice chrysanthemums if only we could discover an insecticide for that insufferable feline pest!

Oxford University Arctic Expedition.

An unusually early summer season, after almost continuous blizzards, is reported in *The Times* from the Oxford University Arctic Expedition in North-East Land.*

After a short journey to the north, Croft and Glen started on a journey around North-East Land which it had been hoped to accomplish later in the summer. Cape Leigh Smith was reached in 4½ days and the two areas of ice-free land which were said to exist to the south of the Cape were found and mapped. From here both Great Island and Giles White Island were clearly visible and much open water was seen in the eastern sea, where a powerful tidal stream runs the straits between the islands.

Blizzards delayed progress for 15 days near Cape Leigh Smith and for eight days at the southern land the wind maintained an average of nearly 40 miles an hour. A group of islands a few miles from the coast was visited for the first time and found to be a breeding area for eider duck; many walruses and seals were seen in the pools of open water near the foot of the ice cliffs, which extend southwards from this point for over 100 miles.

The east coast was finally mapped between the northern area of ice-free land and the ice point, and the important discovery made that the fjord reported by Nordenskiöld does not exist, although a bay with an ice basin inland breaks the coast to the north of the ice point. The south coast was next visited and the ice-free district from Ulve Bay to Cape Torell mapped.

*DISCOVERY, March 1935, p. 75.

The March of Knowledge

Interesting discoveries during excavation on the Megalithic site of Burzahom, near Srinagar in Kashmir, are described in the *Miscellanea* of the American Philosophical Society. Numerous polished stone implements and examples of "black burnished" ceramic ware were found at a depth of 11 ft. from ground level below a brick kitchen floor containing clay hearths. The pottery is similar to the "band ceramic" of Central Europe and regarded as being late Neolithic of approximately 3500-4000 B.C. It is significant that this "black burnished" pottery is identical with the black ware found in Mohenjodaro and not dissimilar to the black ware found mixed with the painted pottery of the earlier Chalcolithic periods of Baluchistan and Persia. This establishes the existence of a late Neolithic culture underlying the Mohenjodaro civilisation, and linked up with the megalithic culture of N.W. India.

At the Golden Gate Park Hall of Science the California Academy has had on exhibition a novel display of minerals. Under ordinary light they presented their usual appearance, but attention was directed to a button at one side of the case. When this was pressed a nico-cobalt lamp was put into circuit and the ultra-violet radiation changed the aspect of the minerals as they fluoresced in the most striking colours.

Two bogies of eight pneumatic-tyred wheels each carry the new L.M.S. "Coventry" petrol-engined railcar, which attained 72 m.p.h. in perfect silence during tests recently. The vehicle is 54 ft. long and carries 56 passengers. Fully loaded, it weighs only 16 tons, some ten tons less than a standard bogie-coach. Should any of the tyres deflate, an electrical warning bell is sounded in the driver's cab.

A vertical lift of 20 ft. was attained by one of the new Autogiros demonstrated on Hounslow Heath recently. The rotors are accelerated for three minutes, and the motor suddenly disconnected. The wing-tips, which have been lagging behind the hub, then tend to overtake it, raise themselves in a lift position, and the stored-up energy in the rotors causes the machine to rise rapidly vertically.

When sufficient height has been attained, the air-

screw clutch is let in, and a normal climb made. No public demonstration of true vertical flight had before been made.

Television of the German 180-line scale, permitting a screen 1×1.2 metres in size, was carried out at the Olympic Games in Berlin. The Telefunken Company have produced a new projection receiver, and a small theatre containing 60 persons has been built. The picture is reported as being of excellent quality, but it has to be viewed at a distance of 20 feet.

The new photometry laboratory in the electrical department was shown to the public at the annual inspection of the National Physical Laboratory recently. This includes a room 145 feet long for the measurement of different types of projectors, such as motor-car headlights, signal lights, and searchlights.

The high voltage laboratory, equipped with a generator of surge voltages up to 2,000,000 volts, has now been provided by the Central Electricity Board with an overhead grid transmission line 3,000 feet long, erected in the laboratory grounds. It is thus possible to study the passage of "surges" travelling along the mission line at 186,000 miles a second, with the object of minimizing the serious consequences which may ensue when an overhead transmission line or pylon is struck by lightning.

Twenty-three young storks, aged about five weeks, arrived by air at Croydon recently. Four were dispatched to the Zoo; from there they will be sent to an estate in Scotland. Fifteen were taken to places in Kent and placed on the cartwheels provided for their nests. The other four were taken to the Haslemere Educational Museum and placed on a cartwheel nest.

A number of human skeletons have been found during building operations near the River Humber. Mr. T. Sheppard, of the Hull Museums, and his staff, have been carefully excavating these burials, and it is believed that they may be the remains of Viking men and women, from the bronze brooches found with them. They had obviously been hurriedly buried, probably after a conflict.

Light on Megalithic Culture.

Fluorescence From Nico-Cobalt Lamp.

Rubber Tyres on Railway.

Vertical Flight at last.

Televising Olympic Games.

Analysing 11,160,000 m.p.h. "Surges."

Storks for England.

Viking Skeletons?

Bird Life on the Farm.

By Eric Hardy, F.Z.S.

Mr. Hardy's observations drawn from his National Bird Census lead to some interesting and rather unexpected conclusions. The legends about the "migration" of sparrows, for example, have been found to be without real foundation.

SOME very interesting conclusions may be drawn from an experimental bird census of Great Britain, taken to get a more scientific idea than at present exists of the resident summer bird population of the country. The agricultural side of the question has not always been dealt with by field ornithologists before, but I was careful enough to realise in the organisation of the counts that bird concentration was apt to vary in proportion, as well as in numbers, in different types of locality, so that land where game birds were reared was specially separated from land without game in the tabulating of statistics, with results that justified such a plan.

Thirty-seven Million Sparrows.

The resident summer bird population of the 56,323,366 acres of Britain worked out at about 200,000,000. Despite suggestions from other quarters that the chaffinch or the meadow-pipit, very numerous birds on the arable lands of the Home Counties, were the commonest British birds, figures clearly indicated the house-sparrow as the most numerous bird, both in town and country, reaching a total of some 37,000,000 which is of course quite understandable when a comparison is made of the counts over northern areas with those over southern districts, the sparrow population of the northern industrial regions being much higher than that of the more open southern districts. Next to the house-sparrow, in order of national abundance, came the blackbird, at 16,000,000, the robin and swallow at about 15,000,000 each, the chaffinch and wood-pigeon at about 13,000,000 each, the wren at about 12,000,000 and the starling at some 11,000,000. In practically all districts blackbirds were slightly more numerous than thrushes, and these birds are increasing. Despite assertions by irresponsible people to the effect that birds are decreasing in number, statistics show they are actually increasing and will be more numerous and concentrated in the land in the future. Bird counts clearly show, that when rural and farm areas are built upon and developed into urban and suburban districts, bird-concentration is increased though bird variety may be decreased; the ribbon-development along the roads increases the population of house-sparrows, thrushes, and similar birds of townships. House-sparrows are relatively scarce in districts devoid of buildings;

starlings increase in rural areas where trees are damaged: I noticed this most where horse ponds are polluted by use as refuse tips as so often occurs now where housing areas approach farms, and boys from towns play around these ponds, smashing the limbs of trees and so affording entry for nesting starlings.

Rooks and Pigeons.

Land where game birds are reared has a more concentrated and varied wild bird population than land without game—this is probably due more to the reduction of vermin and keeping away of trespassers by gamekeepers than to the food put down by keepers—and chaffinch and wood-pigeon in our counts appeared as the most numerous birds on such game lands. There was a marked increase in the rook concentration from the North through the Midlands to the Home Counties while the wood-pigeon concentration was much greater in the Home counties than the west.

In Wales willow-warblers were remarkably numerous. The decline of partridges, corncrakes, and quail, which was reported from practically all districts except a few Lakeland and Welsh hill-side farms, is obviously due to mechanical farming, and perhaps to the use of artificial manures which decrease their natural insect food in the soil: mechanical farming methods are responsible also for the remarkable reduction in the distribution of the corn-cockle flower this century which is much rarer in the fields than formerly. In these counts I was asked by a leading ornithologist to pay special attention to the well-known belief that the young house-sparrows from the cities "migrate" to the rural farms each harvest-time. Ever since my bird-census started six years ago, I have made close observations to find some scientific proof of this universal belief; but I failed to find any evidence to prove the belief as it stands. Over a long period I took day-to-day counts of bird numbers in the Liverpool Cathedral Wild Birds' Sanctuary (where I am bird-recorder) in St. James' Cemetery in the middle of the city, eight miles from open country,* and while this showed distinct movements of starlings and other migratory birds in relation to wind, humidity, etc., there was no evi-

*HARDY, *Bird Migrations and Movements inside Liverpool*, Naturalist, Oct. 1933.

dence that young or adult house-sparrows left the centre of the city for the country, and counts I took on the roofs of suburban areas of Liverpool where the house-sparrow nesting territories were plotted out and carefully watched daily, indicated no such change. The loss of young sparrows from city broods by the following season I attributed to the heavy mortality from cats and frosts. There is certainly a movement of young sparrows from the villages and outskirts of towns to the nearby cornfields at harvest-time, but the clouds of sparrows in the cornfields are made up of the natural offspring of country farms and village houses and there does not seem to be any vast visitation from the centre of the cities as supposed. Bird counts taken with the help of ornithologists of the Liverpool Naturalists' Field Club showed that the sparrow increase on farms in summer was only the natural increase expected when the young took wing and village birds were added. Sparrow numbers are always greater near towns than in distant places.

Some Astounding Figures.

Regarding the Midland areas, counting in the area of the 4,975,749 acres of Leicestershire, Northamptonshire, Nottinghamshire, Warwickshire, Staffordshire, Shropshire, Rutland, Soke of Peterborough, Derbyshire and Worcestershire suggested a total resident bird population of 20,000,000 made up of : 4,500,000 house-sparrows, 1,900,000 swallows, 1,650,000 starlings, 1,500,000 wood-pigeons, 1,107,000 blackbirds, 1,105,000 robins and 900,000 chaffinches, 760,000 swifts, 750,000 greenfinches, 500,000 hedge-sparrows, 375,000 wrens. In the 5,074,181 acres of Wales and Monmouthshire the counts suggested 15,000,000 summer birds made up as follows : 3,000,000 willow-warblers, 2,500,000 house-sparrows, 2,100,000 blackbirds, 2,000,000 chaffinches, 1,500,000 each of wood-pigeon and wren, 1,300,000 of starlings, 1,000,000 blue tits, 900,000 to 1,000,000 song thrushes, 400,000 skylarks, 120,000 cuckoos, 5,000 barn-owls, 600 to 1,000 herons. With the increasing building, the house-sparrows are increasing greatly in Wales, spreading from the towns into the country via the ribbon development along the roads. In the 1,829,991 acres of the North-Western district of Lancashire and Cheshire the bird counts indicated a total of not less than 6,000,000 made up of : 700,000 to 800,000 house-sparrows, 450,000 to 500,000 chaffinches, 400,000 to 450,000 blackbirds, 300,000 to 400,000 song thrushes, 350,000 to 380,000 starlings, 350,000 skylarks, 250,000 wood-pigeons, 200,000 swallows, 150,000 blue tits, 130,000 to 150,000 robins, 100,000 great tits, 80,000 to 100,000 hedge-sparrows, 80,000 each of linnet and wren, 50,000 reed-buntings, moorhens, lapwings

and meadow-pipits, 40,000 missel-thrushes, 5,000 black-headed gulls. The count in many cases indicated that skylarks were more numerous on cultivated than uncultivated land, *e.g.*, more numerous on farm areas than on large manorial estates, but they were highest in numbers on the sand-dunes and duneland golf courses. Seagulls were attracted to farmland chiefly where a fish manure was used : plagues of wireworms attracted rooks, lapwings, and blackheaded gulls, and nurseries with many saplings, especially of birch and poplar, attracted linnets and finches.

Correspondence

ELECTRICAL DETECTION OF EMOTION.

To the Editor of DISCOVERY.

Sir,—I was extremely interested in Dr. R. H. Thouless's article on *The Electrical Detection of Emotion* in the July issue of your journal, but was astounded at the apparent futility with which Dr. Thouless regards his discovery, and the apparent indifference with which he dismisses the subject. I found his article extremely fascinating, and see, in the very near future, world-wide application of his experimental device, to detect criminals in courts of law. I picture before me every suspected criminal or accused with an apparatus of the nature of Dr. Thouless', or of the nature of the medical galvanometer, connected to him, and a medico detective or detective-psychologist seated before the galvanometer. By observation of the changes in the galvanometer as the accused is being cross-questioned or tried, any change in his emotions will at once be revealed, and give valuable clues as to his association with particular circumstances of the crime.

Furthermore, from what I can gather from the substance of his article, Dr. Thouless has brought to light a physiological phenomenon that, so far as I know, has not been previously recorded. Physiologists know that emotion is accompanied by a secretion of adrenalin. The problem then is, to associate a secretion of adrenalin with decreased resistance offered by the body to an electric current passed through it, which Dr. Thouless reports in his article. A possible explanation is that the adrenalin, by increasing the heart rate, and hence the rate of blood flow, facilitates the passage of the current, or it may bring about chemical changes with a similar effect, while its vasoconstrictor effect has also to be borne in mind.

Another very interesting phenomenon reported by Dr. Thouless is the variation of the E.M.F. in the skin of a person experiencing emotion, indicated in his Diagram 2 (B). This is at once familiar to the physiologist as a form of the diphasic wave that accompanies muscular and nervous activity. Unfortunately, Dr. Thouless has not mentioned whether the individual's hand or arm was accompanied by movement during the emotion and recording of the E.M.F. change, as such in itself might have given rise to it. If the diphasic wave was not accompanied by hand or arm movement, and was, therefore, probably due to the emotion, or adrenalin secretion, then another fact of interest has been revealed. The factor of movement might be effectively

eliminated by injection into the hand of a local anæsthetic, which would also eliminate any nervous activity in the hand.

I would hasten to investigate these phenomena myself, but, unfortunately, I am a humble student, and am refused the use of experimental apparatus by my authorities, hence I throw out these suggestions to any one who deems them of sufficient significance to merit further investigation.

Yours faithfully,
E. E. FAERBER.

Johannesburg, S. Africa.

BARISAL GUNS.

To the Editor of DISCOVERY.

Sir,—In reference to your correspondent's query *re* the "Barisal Guns." Prof. W. J. Humphreys ("Physics of the Air," p. 424), says they are, "the rumblings of earthquakes too feeble for registration or other than aural detection." They are most frequent in seismic regions, and the neighbourhood of Calcutta may be called such.

Yours faithfully,
CICELY M. BOTLEY.

Hastings, Sussex.

LIGHT AND SOUND ANALOGY.

To the Editor of DISCOVERY.

Sir,—I should like to thank Mrs. Sargent-Florence for her kind remarks, in your August issue, about my article on Light and Sound Analogy. Her letter, coming from an authority on the subject, is of great interest; and I also thank her for correcting me as to the origin of Newton's colour-scale.

May I reply to a few of the other points she raised?

(1) "Colour-circles," showing complementaries opposite one another, are of great value in training the colour-sense which is naturally possessed, in more or less degree, by all but the colour-blind; and I should have thought that it was exactly the juxtaposition of purple and violet in the chromatic circle that showed up the difference between them. There is quite as much popular confusion I find, between the *names* of almost any two adjacent *spectral* colours—say scarlet or orange-red and red.

(2) (a) Purple is surely not a more "impure" hue than violet, which can be obtained by mixing blue with a little red (either lights or pigments). (b) Though indeed, not present in the arc light spectrum, purple is by many people (including myself) clearly seen beyond the red in any well-developed rainbow.

(3) Rimington's colour-organ was designed to produce colours only—not *sound*—though, I dare say, the colours were accompanied (as suggested in his book) by appropriate instrumental music. Many other inventors have designed such organs, the latest being Major A. B. Klein, M.B.E.

(4) It seems to me impossible to eliminate violet-blue or ultramarine (the hue that Newton so oddly termed "indigo") from any colour scale; for the reason (among others) that it is one of the three hues for each of which a special "receiving-set" of nerve-endings apparently exists at the base of the retina (trichromatic theory). Mr. E. Glasgow, in his recent and highly

interesting book "The Painter's Eye," alludes to the but little-known objective laws of colour-harmony, and writes: "It is not quite fanciful to suppose that one day there may be discovered a real basis of scientific principles for painting, and that such terms as 'harmony,' 'tone,' and 'orchestration' . . . may become as demonstrable as they are in music."

Yours faithfully,
Bloxham, Banbury, Oxon. MARY BARNE.

THE DIVINING ROD.

To the Editor of DISCOVERY.

Sir,—Professor Maby does not go into the details far enough for me to reply on main points. As far as possible I have had the points checked by more than one Diviner. Years ago I found the writings on the subject so unsatisfactory that I set to work to get at the truth without prejudice. I do not believe in many of the scientific instruments, and a leading firm told me that these instruments had proved so unsatisfactory that the firm had refused to handle them. I worked as hard as anyone to get the *Journal of the British Society of Dowisers* started, but until the membership has increased sufficiently to allow of a monthly journal being issued, correspondence will be hopeless. I have offered to submit from time to time articles on new discoveries and have always been met with the objection that these would not be understood by the general reader.

I am not confusing psychic with physical power, and in my case I have the two clearly divided. I feel sure it is not possible for some to become diviners—otherwise, how is it Colonel Bell cannot become a Dowser? Can Professor Maby, with the aid of his laboratory, tell me in what way the power occurs at the scarlet runner, and the effect with the electric lamp? Can he tell me the different effect at a penny with an independent electric lamp, and one held in the hand, or the effect produced with the palm held down repeatedly? What effect will blue clay, potters' clay, or red clay in the soil have in depth-gauging, and what effect will blue clay or red clay or sandstone have on the heart? What effect has a wind?

Will he tell me in what part of Barrett's book one could learn how to locate a spring, or gauge the depth? A great deal of trouble has been caused by many of the "experts," who do not understand the Science arranging tests for Diviners.

Yours faithfully,
Dorking, Surrey. ERNEST CHRISTIE.

Sir J. J. Thomson, O.M., F.R.S., Master of Trinity College, Cambridge, and Trustee of DISCOVERY, is writing a book of reminiscences, which, we are informed, will be published early in the autumn by Messrs. Bell.

The Twelfth Annual Norman Lockyer Lecture of the British Science Guild will be given by the Rt. Hon. Lord Rutherford, O.M., LL.D., D.Sc., F.R.S., on Thursday, 12th November next, in the afternoon. The lecture will take place in the Goldsmiths' Hall, Foster Lane, E.C.2 (by courtesy of the Goldsmiths' Company).

The Moose in Norway

By Sigvald Salvesen

The foothold of the moose in Norway has always been precarious owing to excessive hunting. Mr. Salvesen describes the effect, during his long experience, of the various protective measures that have been tried.

The moose (in Norwegian, elg or stordyr) still occurs in all the south-eastern, eastern and middle parts of Norway (Sorlandet, Ostlandet and Trondelagen) where the natural conditions suit it. That it holds its place well may be seen by the table (p. 295), which shows all bull and cow moose killed in Norway from 1889 to 1925. Wild reindeer and red deer are included in this table, which shows a decline in the case of these animals.

In some parts of the country these animals are totally protected, and in other places only bulls may be killed, while cows and yearlings are protected. From time to time the moose is over-hunted in some districts, but after a few years' protection they come back again. The number of moose that may be killed on each farm is limited and each animal killed must be reported to the sheriff for statistical and controlling purposes. The open seasons at present are, as a rule, a few days from September 26 to 30.

In my home county, Aamli, Arendal, I had a good opportunity to follow the extermination of the moose by over-hunting some ten years ago, and its return in the autumn of 1927. In my childhood, about 1905 to 1912, the stock of moose was especially large. The animals in winter time often came quite close to the farmhouses or were met with on the public roads. Then the open season was from September 10 to September 30, too long a time to shoot these animals. The hunters formed hunting parties of from 15 to 20 men in each party. Across the valleys and hills they set out guard lines of shooters, while others drove the animals against the posted line. In this manner it was impossible for the moose to remain in his domain, and the last one was shot in 1917.

Later on in this district no moose were seen until this October, 1927, when a pair settled in the hills here. One morning a man met them on the moors near the

river Nidelven when a dense fog lay over the landscape. Suddenly the man saw two huge heads among the willow and birch underbrush, one with mighty antlers and both with large, waving ears. The big animals were not afraid and continued biting off twigs and bark. After a little while they moved in the direction of the hills, and were only a few steps from the man. The animals had to pass the railroad, which was fenced on each side. The cow had been caught in the wire and destroyed the fence posts for some yards. She lay down for a little and the railroad men observed it and warned the train arriving. When the train came the animals made for the hills.

The moose often come close to the cities and settled region. In 1913 I lived at Oslo, and in February I remember a moose came walking into the suburban western parts of the town. When jumping a high fence it broke a leg and had to be killed by the police. Also that year a moose came to Oslo and rambled about in the streets till it had to be shot by the police; it was brought to the meat factory. In Vegaarsheia, the

neighbouring parish to Aamli, in 1925, a bull moose was quite tame. It often came to a small farm where the man gave it bread and hay. The bull got so tame that the farmer tied a red ribbon on its antler. Nearly every day it came for its titbits, but at last it turned savage and also began pasturing in the farmers' cabbage and potato fields. It was especially savage at horses, and finally had to be killed by the police because of its offensive habits.

"Have you seen the moose?" this is what everyone was asking each other in Oslo and its surroundings last winter. The unusual deep snow forced the animals to search the roads and farms to try to find something to eat. In Aker, the country surrounding Oslo, two or four moose, walking together, might be seen in many



Female Moose

places. On the greater farms, the owners lay out hay for the animals and in the night they came and took it all.

At Holmenkollen, the famous Norwegian skiing centre, one day in March, two moose—a cow and a bull—came leaping down the main road to Oslo. A van came driving up the road and another car came in the opposite direction. The cars stopped to see what the



Reindeer in Winter

animals would do. The animals then sprang to a fence beside the road, beat with their front feet in the snow and jumped over. The fence was four feet high with barbed wire on top. Later on the the owner of the house near the road saw the two moose stood outside the fence looking at the house.

In the evenings he therefore placed heaps of hay under a big spruce, and in the night the animals came and ate it all. In many orchards the moose did much damage.

To show how many moose came to settled areas last winter, 13 of these animals quite blocked the road from Oslo to Drammen. The animals had to be driven up a side road to make the road passable.

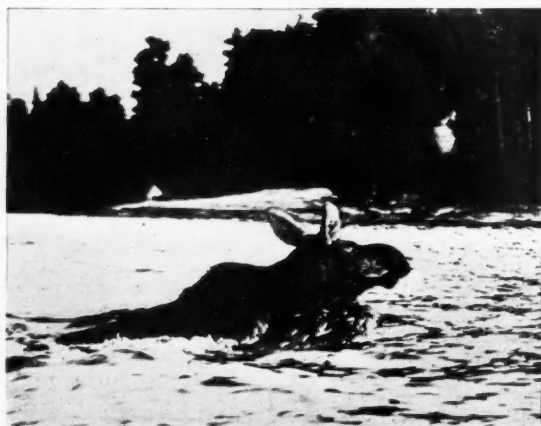
Here in the district of Aust-Agder the moose have been so tame in some places that one feared most of the animals would be killed if an open season was declared. In Aust-Agder the protection has now lasted 15 years. New laws for the hunting of moose for the whole county are now under preparation.

Also at Hamar moose can often be seen in winter, when food is scarce or beneath deep snow. On February 25, 1927, a cow moose with her calf came through the streets of the town at two o'clock in the afternoon. On the open place, Stortorvet, one of them jumped through a plate-glass window. Then both of them continued to the lake and out upon the ice. As the ice was so slippery, the calf could not progress. Some people helped it to the shore again and then both of

the animals made for the forest. A few days later 14 moose were seen walking together near Eidsvold, crossing Lake Herdalssjzen on the ice.

The Norwegian moose lives on roan-tree, saw, aspen, willow, and birch, and less frequently on alder or bird cherry. Also it eats fir leaves and juniper berries and leaves, and pastures in the swamps, where it eats several other plants. In the autumn and winter it eats twigs and bark of the same trees, and sometimes also of Norway spruce, large quantities of ling (heather, bilberries, and red whortleberries) and before the snow comes roots of brackens and some other plants, which it kicks up with its sharp hoofs. Like the reindeer, the moose in winter eats some kinds of lichens.

In southern Norway plenty of mosses, deciduous trees, and other suitable food for these animals exist. Some places in the eastern parts are more overgrown with fir and Norway spruce, and little or no deciduous trees are to be found. On account of this, in winter the moose eats more bark and twigs of these trees and therefore often does much harm to the woods. In Furnes in 1925, five acres of newly planted fir were quite destroyed by herds of moose. The trees were well cleaned of bark and twigs. The animals had also partly broken the trees and eaten the bark by biting over the trunk



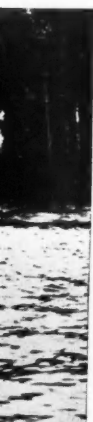
[Photograph by J. N. Elstad]

Moose Swimming a Norwegian Lake

as low as possible and stripping the bark upwards. This damage might perhaps be avoided by letting deciduous trees grow more freely in swamps and in certain parts of the forests. In the eastern part of the country many farmers say they would rather have wood than moose meat and hides, and that fir and spruce are too expensive food to give the animals.

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J. N. Elstad

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The red deer is to be found along the west coast of Norway, in the mountains and on the islands, where it is much hunted, especially on the great islands Froya and Hitra off Trondelagen. The red deer was nearly exterminated forty years ago, but a Mr. Thams bought 20,000 acres around Sognligaard and protected all the wild life there, so that it forms a national park. In this varying ground consisting of backwoods of fir and birch with lakes and grazing grounds the red deer thrives very well. In the 'nineties there were only two or three red deer left, and now there are several hundred.

The reindeer is much worse off. These shy animals live in the vast areas above the tree level, but hunting and other activities have diminished their numbers very much. Reindeer are also bred in semi-domestic manner, and several of these animals have been transported to Alaska by the Norwegian-Americans, "the Lomen Brothers" of Nome.

The roe deer has come back to some extent in the south-eastern parts of the country and also in the south-western parts. On account of the cold winter climate these animals suffer much for lack of food which they have to excavate from under the snow.

Years.	Moose total.	Reindeer total.	Red Deer total.
	Average each year		
1889-1893	1,118	591	145
1894-1898	999	870	139
1899-1903	839	552	237
1904-1908	1,255	1,391	265
1909-1913	1,338	1,044	337
1914-1918	1,118	1,377	300
	Total each year.		
1919	652	984	271
1920	193	963	240
1921	57	825	274
1922	307	672	230
1923	732	494	197
1924	870	347	191
1925	1,186	444	185
1926	1,165	189	389
1927	1,145	174	267
1928	1,165	184	338
1929	1,118	532	320
1930	1,108	378	75
1931	1,229	387	104
1932	1,212	427	90
1933	1,108	460	101
1934	1,190	488	174

Book Reviews.

Motive and Method in a Christian Order. By Sir JOSIAH STAMP, G.C.B. (Epworth Press, 6s.)

Few writers on economic questions to-day can have a wider acquaintance with both theory and practice than Sir Josiah Stamp, and in his Fernley-Hartley lecture for 1936, the first for many years to be delivered by a layman, he draws on this experience to full advantage. In a previous lecture entitled "Can present human motives work a planned society?" he pleaded that some time should now be spared from dealing with plans and planners, and be devoted to a consideration of the "planees." As motive is the special field of Christian teaching, the present discussion of planning in relation to a Christian order followed naturally.

Sir Josiah illustrates the danger of confusing motive and method by relating how indignant the Rector of his parish became when he (Sir Josiah) hesitated to take the chair at a local meeting advocating "Social Credit," the parson interpreting his attitude "almost as apathy in the Christian cause!" While disclaiming any intention of "proving" anything in this book, Sir Josiah suggests certain considerations which should precede the formation and preaching of views on economic questions.

It is fatally easy to assume that wholesale changes in method

would necessarily bring about a better society, even if material needs could be effectively equalised—a point on which the author has grave doubts. "Long and earnestly" he says, "have I tried to conceive the practical way of making the supposed principle of the Vineyard (which, after all, was likened to the 'Kingdom of Heaven') work an economic society in a temperate zone, with a dense population, in such wise that it can be made an immediate goal of policy, in the facile way that some writers are able to do. But I have tried without success." He takes refuge in a resolve to use the principle of need to the utmost in social security, relative taxation, and personal relationships, but believes that the poor now get a better standard than would prevail under a short-sighted attempt at the closest equality.

Sir Josiah Stamp thinks that it will take many generations to raise the motive of the multitude of workers to any common higher plane of service, regardless of comparative personal reward. Yet the more businesses can use and press the non-financial incentives of pride and self-respect, and the less the money-reward incentive dominates the field, the easier will it be to make large transfers to the higher motives of a new order. In common with most thinkers, Sir Josiah recognises that the present order is changing, but it would have been interesting had he indicated the lines on which he thinks further progress will occur or would be most likely to succeed. But whatever the future may bring, there can be no escaping his conclusion that

personal motive is fundamental. For this reason the book should be read by everyone who cares for more than the material side of his work.

J. A. BENN.

The Pilots' Book of Everest. By LORD CLYDESDALE and Flight-Lieutenant M'INTYRE. (Hodge. 10s. 6d.)

This well-illustrated book tells a story which has been told before, but it does so in a new way, from the point of view of the two pilots who were ultimately responsible for the success of the Houston Mount Everest Expedition. Lord Clydesdale writes: "I feel that without a supplement by at least one of the pilots to what has already been written, the lessons learned would be incomplete and the accounts distorted." Certainly, this book is far from superfluous in the light of what has been written before, and provides personal and unofficial touches which have of necessity been lacking hitherto.

One point brought out very clearly, though with some restraint, is that expeditions which have to barter film rights to help meet expenses increase their labours manyfold thereby. Many hours were spent "on the set" under the command of a tireless film director who was for ever having ideas and would not rest until they were put into effect successfully, but such was the good feeling among members of the party that the willy-nilly film stars played their part philosophically and the peace was not disturbed.

Any idea that flying over Everest is either easy or safe is dispelled by the pilots' accounts of their two flights, though they were, of course, modest in the extreme and barely hint at any doubts they may have had at critical moments. Only very skilful flying and the expedition's habit of doing its thinking on the ground, so that no time was lost in emergencies, could have saved the machines from the severe down-draught they encountered on the first trip to the mountain on April 3rd, 1933.

A struggle of another order ensued before the second flight on April 19th. Public imagination had been satisfied by the first flight, whereas the members of the expedition and particularly the pilots were only too conscious of the fact that from the survey point of view that flight had been a failure. Air-Commodore Fellowes's forced landing owing to lack of petrol on the return from his flight to Kanchenjunga stirred public imagination in another way, and a stream of prohibitory telegrams began to descend upon Purnea. These were answered with protest, argument, and appeal, but without success. The Air-Commodore began to make plans for packing up. Then he fell ill with fever, and in the meantime a plot was brewed by the pilots and a few confidants. Bad weather delayed putting this plot into effect and the Air-Commodore began to recover. On the evening of April 18th the conspirators hinted to the doctor that he would be doing them and the Air-Commodore a service if he could keep him in bed till lunch-time on the following day.

At dawn on April 19th, leaving the Air-Commodore still in bed, they slid quietly out of their bungalow, determined to complete their survey. They were prepared to be adjudged insubordinate and to lift, by their insubordination, all responsibility from the shoulders of their commanding officer. "It was felt," says Lord Clydesdale, "that if we returned safely, very little could be done to us by the home authority, whose orders it was our intention to defy." Not only did they return safely, but they completed the survey. It was their intention at first, and they did their best to persuade the Air-Commodore to agree,

that their flight should remain a secret, but the news leaked out and nothing was done to "the insubordinates."

The aims of the expedition as given by Lord Clydesdale were to make certain that air photography for mapping purposes could be used over rapidly-rising country; to discover the peculiar conditions attaching to air survey over the highest point on the earth's surface, and to bring back survey strips showing some of the physical features of the southern face of Everest, which is inaccessible to surveying parties on the ground. In all of these the expedition was successful.

The peculiar problems of photography are discussed in a chapter on the results of the expedition, and there is also an interesting chapter on high altitude flying, though the "modest adventures" of the expedition were not intended to be experimental in that direction. As in the case of the climbers the pilots found that some of the fetishes of high-altitude effect on the human mind and body have no sound foundation.

A. J. M. HARRIS.

Scenery and the Sense of Sight. By VAUGHAN CORNISH. (Cambridge University Press. 7s. 6d.)

Only a very small proportion of the multitudes who discover satisfaction in the varied forms of inland or coastal scenery ever pause to consider why a scene of rugged or pastoral beauty should be more pleasing to the eye at one time than another. Dr. Cornish has studied this question and allied problems of scenery assiduously over a long period of time and has been very successful in describing his point of view so that it is easily understandable by the general reader.

There is a wealth of detailed local analysis throughout the volume. To take one particular example, it is shown how the unfenced and bare pastures of the chalk downs of Southern England, with their broad sweep of unbroken undulation, harmonise with the curves of the cumulus clouds. But in the case of the woodland landscape of the Weald there is no similar pictorial combination. In the former view there is no difference in the size of the field of vision required for land and sky and so the horizon is the axis of a balanced composition of two harmonious patterns of form.

This and other examples demonstrate the manner in which many of the aesthetic impressions of scenery can be traced to the unconscious habits of the eye. Further they show how the satisfaction of the eye by form or colour may often be the explanation of our pleasure in a scene where more plausible explanations would be some association of ideas connected with the character of the objects viewed, or attributable to some spiritual faculty higher than ordinary thought.

In exploring the apparent magnitude of features in the field of view and the field of pictorial vision, the expanse of landscape that the eye naturally includes in a view is measured by the author from drawings made of various types of scenery. This was found to vary enormously and from a measurement of the area of the horizon subtended by the view the author discovered that although "it seemed obvious that the arc of the horizon embraced in the spontaneous view was much greater when looking across the open bay than when shut in by lofty mountain peaks," it was found that the exact opposite was the case. This observation confirms the curious fact that "the more the eye takes in vertically the more it takes in horizontally and the less impressive are both dimensions."

This and other deductions may not be altogether accepted as true. But they are certainly shown to rest on the facts of very definite observation, and scientific interpretation. The author

has certainly presented the reader with well sustained arguments for his consideration.

An Historical Geography of England before 1800. Fourteen Studies, edited by H. C. DARBY. (Cambridge University Press. 25s.)

Modern geographers have extended the bounds of their science to include economic and sociological matters as well as purely physical facts. Thus the historical geography of England which Dr. Darby and his geographical colleagues have written really presents the whole background of our political history as seen age by age from prehistoric times to the reign of George the Third. It is a fascinating book, which brings together for the first time an immense mass of scattered material and makes it intelligible, with the help of many ingenious economic maps. The contributors have been left free to treat their periods as seemed to them best, so that one tends to emphasize the geological aspects, another the economic problems, while Professor Ekwall discusses the Scandinavian settlement mainly from the evidence of place-names and incidentally shows that it covered a far larger part of the Midlands and the North than is generally supposed. But this variety of treatment gives colour and relief to the book, and occasional differences of opinion among the essayists merely show that the evidence is conflicting and far from complete.

Indeed, while one is impressed by the amount of information that research has unearthed about our mediæval society, one is left convinced that there is very much more to discover. The early economic historians who hastily assumed that the three-field system was practised in all English villages were certainly mistaken, and it is quite obvious from this book that enclosures without which farmers could never have progressed, began in various districts—especially Kent—long before the Reformation. The elaborate organisation of English mediæval trade, always with its centre in London, is admirably described, with much new detail. It is shown that English roads were throughout—at any rate up to the eighteenth century—a great deal better than is supposed by those who generalise from strong comments by Defoe and others. Transport by cart as well as by pack-horse was customary in most districts in Henry the Eighth's time, as we see from Leland's travels, here well expounded by Professor E. G. R. Taylor. Some, but not all, of the roads were ruined in and after the Civil Wars; but these were usually the roads across stretches of heavy clay, whereas most of the old roads followed the outcrops of limestone and sandstone. There is much interesting detail about the ports, especially Bristol and Southampton and King's Lynn which in the fourteenth century ranked with Hull and Boston as an exporter of wool and cloth. The woollen trade again is closely studied in successive periods up to the time when it began to migrate from East Anglia and the West country to the North. Two maps of the distribution of population in 1700 and 1801 respectively illustrate the tremendous changes that the century witnessed. Lancashire, the West Riding, and the Black Country of the West Midlands, hitherto sparsely populated rural districts, rapidly filled up. Nowadays that movement is being reversed and setting us much the same social problems that our Georgian forefathers had to face. The book includes a good chapter on the Draining of the Fens and ends with a short account of the growth of London from 1600. It may be commended without reserve to all who are interested in England's past.

E. G. HAWKE.

Wasted Lives. By W. F. LESTRANGE. (Routledge. 7s. 6d.)

This is a volume of 128 quarto pages of which part consists of admirable photographs, taken in many cases by the author himself. The title suggests the subject, industry's toll on manpower and human potentialities. The book falls into four sections, though they are not divided as clearly as they might be. The first deals with housing, the second with education, the third with "blind-alley" employment, and the fourth with the Special (or Derelict) Areas.

The ground no doubt has already been covered many times. But in this volume Mr. Lestrangle gives us a vivid, distressing, and very readable description from his own observations and experiences in travelling "for a matter of three to four thousand miles" throughout England and Wales. He does not attempt to offer a solution of the problems he outlines beyond telling us that he would like to see "a decent home for everyone," "decent schools for every child," and the raising of the school leaving age to 17 in the course of the next few years. Unfortunately he does not suggest how all this could be done without intensifying the evils he wishes to cure; nor unfortunately does he give us practical guidance for the application of his admirable ideal of remunerating work according to what it exacts from the worker in strain, weariness, or soullessness. Mr. Lestrangle forcefully describes the evils and it is for the economist and the psychologist together to show how they can be cured.

J. H. BLAKSLEY

The Measurement of Population Growth. By ROBERT R. KUCZYNSKI. (Sidgwick & Jackson. 12s. 6d.)

This book is primarily a study of fertility. Mortality, it is expressly stated by the author, is only considered in so far as it counteracts the results of fertility; immigration and emigration are not discussed at all. The author's reason for this choice of subject is that while in former times mortality was the decisive factor in determining population growth, to-day it is fertility. This is because, in former times, birth control of married women did not affect fertility to any appreciable extent, the ratio of fertility (actual production of children) to fecundity (child-bearing capacity) was probably fairly constant while mortality fluctuated enormously. "To-day the situation is quite different in all countries of western civilization. With the ever increasing spread of birth control the gap between fecundity and fertility has been widened more and more. Mortality on the other hand, no longer fluctuates extensively. The decisive factor in determining present population growth, therefore, is fertility." Another reason is that the measurement of fertility is not as widely understood as the measurement of mortality and inadequate methods, the author considers, are often used. The business of life-insurance companies, public health policies and the fact that mortality was formerly the decisive factor, have all tended to lead a much more intensive study of the measurement of mortality than of fertility. Here is an attempt to redress the balance.

The book starts with a chapter on the appraisal of birth statistics, and some useful hints are given to the student for testing the accuracy of his data. Then comes a detailed study of the ratio of births to marriages as a measure of fertility. All the defects are carefully considered—the complication of second marriages and illegitimate births and above all the fact that,

if we take the ratio of births to marriages in the same year, the births are not related to the marriages which produced them. The conclusion is melancholy. "When Graunt wanted to measure the fertility of 'a certain Parish in Hampshire' he had no other alternative but to divide births by marriages, since he did not know the age distribution of his population; but once censuses had been taken there was no longer a justification for using this method or any other method based on the exclusive use of vital (*i.e.*, registration) statistics, since the intrinsic fallacy of all these methods cannot possibly be eliminated even by the most ingenious modifications."

The author is equally dissatisfied with the exclusive use of census statistics. He gives rather an adverse criticism of the fertility enquiry made in the English census of 1911. On this occasion each married woman was asked the number of years her present marriage had lasted, and the number of children born alive to her present marriage, the latter to be subdivided into "children still living" and "children who had died." He concludes that the English fertility census of 1911, makes the decline of fertility appear considerably greater than it actually was.

After this lengthy and critical historical *résumé*, we come at last to methods of which the author approves (and he is undoubtedly right in principle) the use of registration and census statistics in combination. There is a good discussion of the birth rate and of general and specific fertility rates, but it is the *gross reproduction rate* which is emphasised. This measure, obtained by totalling the specific fertility rates for each year of life throughout the child-bearing period (here taken as 15-50 years) gives the number of girls who would be born on the average to each woman who passed right through the child-bearing period. It is quite independent of mortality, and if it is less than unity, then however low the death-rate the population could not, in the long run, maintain itself. Following a good chapter on mortality, in which, however, the standardised death-rate is somewhat harshly criticised, there is some consideration of the balance of births and deaths. Here it is the *net reproduction rate* which is emphasised. This is the average number of girls born to each woman during the child-bearing period taking the mortality of these women into account as well as their fertility. It is the net reproduction rate which measures whether the population is maintaining itself or not. In 1933 England had a net reproduction rate of 0.735 and for most of the countries of Europe it was less than unity; for the whole of Western and Northern Europe it was 0.76.

Finally there is some discussion of the condition under which a population can remain stable, *i.e.*, with the same birth rate, death rate, and age composition. The results of a computation by Dr. Enid Charles for England are given and are worth quoting.

"It appears that if fertility and mortality should remain what they were in 1933, the population of England, which in 1933 was 40,350,000, would increase by about 550,000 more and would reach its peak in 1943, when the birth and death rates would be 13.85 and 13.84 respectively. From then on it would decrease constantly. In 1953 it would drop to the level of 1933 with a birth rate of 12.84 and a death rate of 15.45. By the year 2000 the population would be reduced to 29,270,000 or by 27.5 per cent. as compared with 1933. The birth and death rate would be 11.1 and 21.4 respectively, that is to say they would correspond to the birth and death rates of the stable population. It would thus take two-thirds of a century until the stable population would be reached approximately, and the population in this period would decrease by only 27.5

per cent. But from then on the population would decrease by 26.6 per cent., every generation, *i.e.*, every 30 years."

The main criticism we have to make of the book is that it gives too much space, initially, to criticising the work of other writers of whose methods the author disapproves. He should first have given an exposition of the principles he considers right and the historical and other criticisms should have come later. It is somewhat confusing and discouraging to the student to be presented with a number of methods which are subsequently shown to be wrong. Nevertheless the book will induce a lot of wholesome thinking in the careful reader, and we have nothing but admiration for the painstaking work and computation which must have gone to its preparation. The information in the tables alone makes the book worth having.

J. O. IRWIN

The Cambridge Mediæval History. Edited by C. W. PREVITÉ-ORTON and Z. N. BROOKE. Vol. VIII. *The Close of the Middle Ages.* (Cambridge University Press. 50s., with a case of maps.)

The completion of the Cambridge Mediæval History, twenty-five years after the first of the eight massive octavos appeared, is a memorable event. The University which undertook this worthy enterprise, the successive editors who have worked out the late Professor Bury's plan, and the many British and foreign scholars who have contributed the chapters, are all most heartily to be commended. For there is no similar book of equal authority in any language. While German and French editors of such encyclopædic works rely upon their own compatriots, the Cambridge editors have sought their specialists abroad as well as at home. Nine out of the twenty-five chapters in Volume 8 are by foreign hands—Czech, French, Belgium, Spanish, Norwegian and Hungarian. It is really an international undertaking, and gains very greatly in interest and value on that account. Indeed in no other way could the many parts of so vast and complex a subject be treated with equal accuracy.

As one looks back over the previous volumes, one realises afresh how they abound both in good chapters on the relatively familiar topics and in unique special articles on subjects that are seldom treated in English. In Volume 1, for example, which began with Constantine, there were Vinogradoff's chapter on the economic condition of the later Empire and Peisker's on Central Asia with its nomadic tribes about to burst forth. In the second and third volumes Corbett's chapters on Anglo-Saxon England, Dr. Mawer's on the Vikings, and the accounts by other hands of the Franks, Slavs and Celts are of exceptional importance. The fourth volume, devoted to the Byzantine Empire, is the standard authority for that vast and fascinating subject. The last four volumes cover roughly a century apiece, from the Norman Conquest and First Crusade onwards, so that Volume 8 is concerned with the fifteenth century, and each, it may justly be said, is full of new matter as well as of old matter rehandled in the light of modern research.

As Dr. Previté-Orton suggests in his brilliant epilogue to the closing volume, the fifteenth century, which we are taught to regard as the end of the Middle Ages, may equally well be thought of as the prelude to modern times. It was a period of transition—perhaps not unlike our own—when lip-service was still paid to ancient institutions that new ideas had readily undermined. There is an air of uncertainty about it, such as one feels in the Emperor Maximilian's elaborate chivalrous romances which had

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no relation whatever to the sordid brutality of war and politics in his time. Fifteenth-century England has been neglected except by the economists just because it is so baffling and confused. Mr. McFarlane's and Professor C. H. Williams's excellent chapters on the Lancastrians and the Yorkists respectively reflect the uncertainty which the shrewdest students of the period feel. Mr. McFarlane tends to assign more importance to the early Lancastrian Parliaments than recent writers would allow them, but admits that Parliament lost ground later. Professor Williams, who rightly comments rather than chronicles, brings out the essential weakness of Edward IV and his brother Richard III in that, unlike the Tudors, they did not know what to do in order to save the State. It is wrong, he thinks, to infer from their popularity in London that they had any settled policy for trade. At any rate they did not repress, as the Tudors did, the local magnates who kept the country in such turmoil as the Paston Letters reveal. Yet, despite this lack of governance, the towns and the wool centres must have been amazingly prosperous, as their fine churches and manor-houses in East Anglia and the West show very clearly. Professor Williams thinks that the Wars of the Roses cannot have devastated the country as a whole, though some places suffered. Nor did the mass of the people participate in these baronial feuds.

Among the more notable of the foreign sections "The Low Countries," by the late Henri Pirenne, the great Belgian historian, stands out as masterly. He shows, for example, how the gradual development of the Burgundian power, raised to its zenith by Philip the Good and shattered by the folly of his son Charles the Bold, served to make what we now call Belgium and Holland independent both of France and of the Empire and to give them experience in self-government. Professor Calmette describes very well the closing stages of the Hundred Years' War and Dr. Petit-Dutaillis gives a most interesting sketch of that horribly clever despot, Louis XI, to whom France owed much. We can understand modern Czecho-Slovakia all the better after reading the two chapters on John Hus and the Bohemia of his day which are contributed by Dr. Krofta, who is at once the Professor of Bohemian History at Prague and Minister of Foreign Affairs in the Republic. Again, Dr. Koht, who combines the same two offices at Oslo, deals with Scandinavia in the fourteenth and fifteenth centuries, while Mr. Homan, the Hungarian Minister for Education, writes of Hungary in the same period. Literature and art have throughout the work been fully considered, and Professor Constable's and Mr. Arthur Tilley's chapters on Gothic art and on the Renaissance maintain the very high standard that has been set. The volume includes the usual extensive bibliographies, a full though not quite perfect index and a case of most useful maps, few of which could be found elsewhere. For many years to come the Cambridge Mediaeval History will assuredly interest and stimulate students all over the English-speaking world.

Rockets through Space. By P. E. CLEATOR. (Allen & Unwin. 7s. 6d.)

Since H. G. Wells wrote *The First Men in the Moon* and conceived the idea of that delightful scientific paradox which he named "Cavorite," the world has been intrigued by the thought that one day we may fly to the planets. It was therefore inevitable that sooner or later there would appear in book form some serious treatise dealing with the problem, and the author, by reason of his many public lectures and writings on the subject,

is perhaps the most competent authority in the country to do justice to such a work.

The book has benefited by the inclusion of many diagrams and photographs hitherto unavailable. As the author points out, the rocket motor of to-day with its water-cooled blast chamber, its complicated system of pressure feeds, safety valves and dual liquid-fuel storage tanks, little resembles the old-style cardboard tube and gunpowder. Radical alterations have been necessitated by the increasing power and efficiency of these reaction motors.

Some ingenious ideas are presented in the chapters devoted to the "ways and means" of extra-terrestrial flight, but the author is fundamentally wrong in stating that with our present resources it is possible to build a space-ship capable of escaping the earth's gravitational field. The energy-weight ratio of even oxy-hydrogen fuel falls far short of the theoretical minimum, and an examination of the proposed three-stage rocket-ship exposes a fallacy when the stage system is increased to infinity. Similar remarks apply to the scheme for building a metal outpost satellite and propelling it in a fixed orbit 600 miles above the earth's surface. Nevertheless the book is quite well written and very informative as to the situation in the science of "rocketry."

How to know British Birds. By NORMAN H. JOY. (Witherby 5s.)

Birds of the Green Belt. By R. M. LOCKLEY. (Witherby. 5s.)

These two little books, each admirably conceived, will seem complementary to each other to bird lovers living in or around London. *How to Know British Birds* is a very concise work of reference, giving illustration, coloured and uncoloured, of all British birds, with brief notes on their peculiarities of song, distribution, etc. *Birds of the Green Belt* is devoted primarily to bird life within about 25 miles of St. Paul's. Readers will find much to fascinate them in this book, whether their walks are confined chiefly to "beauty spots" like Ashridge or Epping Forest and the birds are just a part of the attractiveness of the landscape (and thus contribute their share to a general feeling of well-being), or whether they belong to that more fortunate class of walker for whom the birds are the thing. They will then follow Mr. Lockley to reservoirs and sewage farms with much profit, and, if lucky, may find material for many letters to *The Times*! A final practical point: both books can be easily slipped into the pocket, while *Birds of the Green Belt* contains a useful transport guide of train and bus routes.

Behind the Smile in Real Japan. By E. K. VENABLES. (Harrap. 10s. 6d.)

Mr. Venables has given us an interesting and enlightening volume on an interesting race. If he has a fault it is that he is too instructional, and talks down to his audience somewhat—but then is not the average European ignorance of Japan almost abysmal? An occasional touch of humour, moreover, relieves the suspicion of pedagogy.

Young Westerners reading this book may thank their stars that they do not have to contend with the hardships faced by their contemporaries of the East. The Nipponese attitude to any inconvenience, great or small, is *shikata ga nai* (it can't be helped) and there the matter ends. Much else in this account of the strange customs and scenes of life in Japan will come as a surprise to the uninitiated.

The illustrations have been carefully selected and show in profusion the various periods of the life of the citizen of Nippon.

A Key to Precious Stones. By L. J. SPENCER. (Blackie. 5s.)

The author of this book is a distinguished mineralogist, having been keeper of the Collection of Minerals at the Natural History Museum, South Kensington, from 1927 to 1935. In popular language he gives a general account of the properties and composition of gem-stones, explaining where they are found in the crust of the earth and to what uses they can be put. The mysteries and feelings of æsthetic rapture, so often associated with gem-stones, are kept in the background, whilst prominence is given to hard facts, and, in the author's own words, "the driest (but really the most important) of these are assembled at the end of each chapter as key tables for purposes of reference." He makes some really interesting remarks upon the names of gem-stones, which are "often confusing and, indeed, deliberately misleading." The book itself is divided into two sections, the first part dealing with general principles, such as colour, lustre and brilliancy, density and hardness, crystal forms, optical characters, geological occurrence, origin, and cutting and polishing of gem-stones, whilst the second part is descriptive of twelve groups of stones.

The Struggle for Population. By D. V. GLASS. (Oxford University Press. 7s. 6d.)

One can categorically state that this is a very important book, mainly because it collects relevant statistics, hitherto uncriticised, which bear on the most urgent of all problems, that of providing a future population to carry on our civilisation, supposing that this is agreed to be desirable. There is no trace of prejudice, but a clear desire to show the data to be used by a Committee of the Eugenics Society in their future study of the problem. Professor Carr-Saunders may believe that this country is not over-populated, but this is a small point in comparison with the diminution to be expected in the future, if effective steps are not taken to rectify the position. Making defensible assumptions regarding the present decline in net reproductive rate, it is possible that the population of England and Wales will decline to four millions in a hundred years; if the present rate is rectified to what it was in 1931 the drop will be to 20 millions. In each case the decline continues, there is no possibility of suddenly calling a halt; to establish what might be thought an optimum population requires complete control now. The most valuable part of the book concerns the attempts made abroad to remedy similar declines, which have been anticipated for many years.

Antagonistic phenomena to population growth are said to be birth control and abortion; remedial measures are anti-contraception and anti-abortion laws and family allowances. Much has been made of these abroad, but the author cannot find any clear indication that any are really effective towards the desired end. Normal restrictions on the sale or advertisement of contraceptives are quite useless since birth control is a means to an end, which is mainly controlled by economic conditions; given any intelligence, people will find methods of restricting the numbers in their families. Abortion is, however, an end itself. When we consider numbers and find that in France and Belgium abortions exceed live births; that in Berlin the proportion was even higher until recently controlled down; that the trivial figure given by Italy is suspect; that abortion is very prevalent in the United States; when we read the evidence in the recent prosecution of a woman doctor indicating the widespread attempts at abortion in this country, and, above all,

the harsh sentence imposed by law on this lady for doing what she conceived to be her duty, we are certainly led to believe that some re-orientation regarding maternity is overdue, and that society should think again before it imposes narrow social taboos on those who, in other circumstances, might be willing to partake in the pivotal fact of nature, reproduction.

Family allowances were introduced during the war in France to maintain equality of standard of living amongst the poorest classes, with no pretence at influencing their fertility. With a number of variations, it has been re-oriented to that end both in France, Belgium and Italy, with a marriage bonus scheme in Germany to remove women from industry. Careful examination of the claims fails to substantiate them and the author believes that they are economically totally inadequate for any effect to be felt, although the general conclusion regarding this drop in fertility is based on economics. The author's examination of the data is impressive, and shows how precisely figures must be handled before valid conclusions can be drawn.

There is one way to increase fertility which might be further examined. If all women were turned out of intelligent employment and their domestic budget assured, they would become so bored that there would be nothing else to do but have children. If the increasing freedom of women is a sign of progressing civilisation, it may be necessary to sacrifice civilisation in order to save it.

L. E. C. HUGHES.

A Dictionary of British Wayside Trees. By A. W. HOLBROOK (Country Life, Ltd. 7s. 6d.)

This handbook, with round corners to make it easily pocketable, should be very welcome to all lovers of the English countryside, even the most perfunctory. For the trees are always with us, summer and winter alike; and Mr. Holbrook's easily-followed descriptions, coupled with his excellently clear illustrations, should make the identification of any wayside tree or shrub an easy matter—whether it is in full leaf, or whether the inquirer has only a dry twig or cone or so as evidence. As a companion to autumn walks the value of this *Dictionary* would seem specially high; wild flowers are on the wane, but trees are in the height of their glory, and Mr. Holbrook adds an interest to the fall of the year that should go far to distract us from its melancholy.

Playtime in Portugal. By JOHN GIBBONS. (Methuen. 6s.)

Mr. Gibbons is rapidly becoming, in his own particular manner a leading authority on Southern Portugal. The present volume, though burdened with a totally misleading title, is one of the best books we have read on the Algarves, and is as unconventional as its sub-title claims. Of late years there has been quite a considerable outpouring of "picturesque" literature in English on the Portuguese and their land; but in our view Mr. Gibbons has caught the spirit of the country better than any of his compatriots; and, what is more, he spells topographical names correctly. This is an admirable companion to the regulation guide-book for any visitor to Portugal south of the Tagus, and it has a few cogent words to say about Lisbon, the Estoril, and Cintra. Visitors to the little-known Algarve coast will find Mr. Gibbons an agreeable and trustworthy cicerone.

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